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September 1994

0830-J-01

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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NASA SP-7011 (392)
September 1994

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

National Aeronautics and Space Administration
Scientific and Technical Information Program
Washington, DC 1994

This publication was prepared by the NASA Center for AeroSpace Information,
800 Elkridge Landing Road, Linthicum Heights, MD 21090-2934, (301) 621-0390.

INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 81 reports, articles, and other documents recently announced in the NASA STI Database. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue include:

Scientific and Technical Aerospace Reports (STAR) (N-10000 Series)	N94-33357 — N94-35225
Open Literature (A-60000 Series)	A94-60001 — A94-60255

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract number, report number, and accession number—are included.

A cumulative index for 1994 will be published in early 1995.

Information on availability of documents listed, addresses of organizations, and CASI price schedules are located at the back of this issue.

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Category 54 Man/System Technology and Life Support 252
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Category 55 Space Biology 259
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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → **N94-11045*#** Pennsylvania State Univ., Hershey. Coll. of Medicine. ← **CORPORATE SOURCE**

TITLE → **EFFECTS OF CSF HORMONES AND IONIC COMPOSITION ON SALT/WATER METABOLISM Final Technical Report, 1 Mar. 1981 - 31 Dec. 1992**

AUTHOR → WALTER B. SEVERS 31 Dec. 1992 32 p ← **PUBLICATION DATE**

CONTRACT NUMBER → (Contract NCC2-127)

REPORT NUMBERS → (NASA-CR-193232; NAS 1.26:193232) Avail: CASI HC A03/MF A01 ← **AVAILABILITY AND PRICE CODE**

The consequences of headward fluid shifts during manned spaceflight was studied. Such shifts were recognized early by both U.S. and Soviet scientists because of signs and symptoms referable to the head. Some of these include disturbed vision, puffiness in the face and periorbital areas, headache, vestibular dysfunction, and distended jugular veins. We posited that the fluid shift had an immediate effect on the brain and a long-term action requiring a neural interpretation of the flight environment. This would re-adjust both efferent neural as well as hormonal mechanisms to sustain cardiovascular and fluid/electrolyte balance consonent with survival in microgravity. Work along these lines is summarized. A synopsis of some of the main research is presented. The following topics were studied: (1) angiotensin and vasopressin action in the central nervous system; (2) intracranial pressure control; (3) research on subcommissural organ; and (4) research on the eye.

Author (revised)

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

ACCESSION NUMBER → **A94-60203**

TITLE → **ESTIMATION OF THE LOW-EARTH-ORBIT DEBRIS POPULATION AND DISTRIBUTION**

AUTHORS → KYLE T. ALFRIEND General Research Corp., VA and ← **AUTHORS' AFFILIATION**
D. LAURIE LEWIS Journal of Spacecraft and Rockets (ISSN 0022- ← **JOURNAL TITLE**
4650) vol. 31, no. 1 January-February 1994 p. 48-53 refs ← **PUBLICATION DATE**

REPORT NUMBER → (BTN-94-EIX94311322893) Copyright

In this paper, an algorithm for estimating the low-Earth-orbit space object population and distribution from measurements taken by a vertical, staring narrow beam radar is developed and validated. The radar measures the altitude, inclination, and radar cross section of each object which passes through the beam. The effects of the assumptions made in developing the algorithm and measurement errors are discussed. An estimate of the operational time of the radar needed to achieve a specified accuracy in the space object population is also developed.

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AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 392)

September 1994

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LIFE SCIENCES (GENERAL)

N94-33564* National Aeronautics and Space Administration, Washington, DC.
ASSISTING WINE GROWERS (Videotape)
1993 Videotape: 6 min. 25 sec. playing time, in color, with sound
(NASA-TM-109812; NONP-VT-94-12940) Avail: CASI VHS A01/BETA A22

This video documents efforts at NASA Ames Research Center to assist wine growers in the Napa valley in their fight against a root parasite which is destroying millions of dollars worth of grape crops. NASA researchers are using airborne scanners and remote sensing equipment to detect the parasite before it becomes entrenched, so that growers can treat the harvest to resist infestation. CASI

N94-33658*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
CONTINUOUS MONITORING OF BACTERIAL ATTACHMENT Abstract Only
D. W. KOEING (Krug Life Sciences, Inc., Houston, TX.), S. K. MISHRA (Krug Life Sciences, Inc., Houston, TX.), and D. L. PIERSON *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 599 Jan. 1994
Avail: CASI HC A01/MF A03

A major concern with the Space Station Freedom (SSF) water supply system is the control of longterm microbial contamination and biofilm development in the water storage and distribution systems. These biofilms have the potential for harboring pathogens as well as microbial strains containing resistance factors that could negatively influence crew health. The proposed means for disinfecting the water system on SSF (iodine) may encourage the selection of resistant strains. In fact, biofilm bacteria were observed in water lines from the Space Shuttle Columbia (OV-102); therefore, an alternative remediation method is required to disinfect spacecraft water lines. A thorough understanding of colonization events and the physiological parameters that will influence bacteria adhesion is required. The limiting factor for development of this technology is the ability to continuously monitor adhesion events and the effects of biocides on sessile bacteria. Methods were developed to allow bacterial adhesion and subsequent biocidal treatment to be monitored continuously. This technique couples automated image analysis with a continuous flow of a bacterial suspension through an optical flow cell. A strain of Pseudomonas cepacia isolated from the water supply of the Space Shuttle Discovery (OV-103) during STS-39 was grown in a nitrogen-limited continuous culture. This culture was challenged continuously with iodine during growth, and the adhesion characteristics of this strain was measure with regard to flow rate. Various biocides (ozone, hypochlorite, and iodine) were added to the flow stream to evaluate how well each chemical removed the bacteria. After biocide treatment, a fresh bacterial suspension was introduced into the flow cell, and the attachment rate was evaluated on the previously treated surface. This secondary fouling was again treated with biocide to determine the efficacy of multiple batch chemical treatments in removing biofilm. Author (revised)

N94-33734# Los Alamos National Lab., NM.
PHASE-SENSITIVE FLOW CYTOMETRY: NEW TECHNOLOGY FOR ANALYZING BIOCHEMICAL, FUNCTIONAL, AND STRUCTURAL FEATURES IN FLUOROCHROME-LABELED CELLS AND PARTICLES
J. A. STEINKAMP 1993 4 p Presented at the 4th Laser Applications to Chemical Analysis Meeting, Jackson Hole, WY, 8-11 Mar. 1994
(Contract W-7405-ENG-36)
(DE94-003960; LA-UR-93-3960; CONF-940341-2) Avail: CASI HC A01/MF A01

Flow cytometry (FCM) instruments rapidly measure biochemical, functional, and cytological properties of individual cells and macromolecular components, e.g., chromosomes, for clinical diagnostic medicine and biomedical and environmental research applications. These measurements are based on labeling cells with multiple fluorochromes for correlated analysis of macromolecules, such as DNA, RNA, protein, and cell-surface receptors. This report describes the development of a phase-sensitive flow cytometer that provides unique capabilities for making laser-excited, phase-resolved measurements on fluorochrome-labelled cells and particles. DOE

N94-33770* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
KSC WILDLIFE SHOW (Videotape)
1994 Videotape: 30 min. playing time, in color, with sound
(NASA-TM-109808; NONP-VT-94-12936) Avail: CASI VHS A01/BETA A22

This video highlights footage of the many forms of animal and plant life that inhabit the environs surrounding KSC. Shown are birds, alligators, butterflies, and plants as they react to shuttle launches and other activities eminating from KSC. CASI

N94-34008# Stanford Univ., CA. Dept. of Biological Sciences.
ENZYMOLOGY AND MOLECULAR BIOLOGY OF CELL WALL BIOSYNTHESIS
P. M. RAY 20 Mar. 1993 7 p
(Contract DE-FG03-91ER-20048)
(DE94-008585; DOE/ER-20048/2) Avail: CASI HC A02/MF A01

In order to be able to explore the control of cell wall polysaccharide synthesis at the molecular level, which inter alia might eventually lead to means for useful modification of plant biomass polysaccharide production, the immediate goals of this project are to identify polypeptides responsible for wall polysaccharide synthase activities and to obtain clones of the genes that encode them. We are concentrating on plasma membrane-associated (1,3)-beta-glucan synthase (glucan synthase-II or GS-II) and Golgi-associated (1,4)-(beta)-glucan synthase (glucan synthase-I or GS-I), of growing pea stem tissue. Our progress has been much more rapid with respect to GS-II than regarding GS-I. DOE

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A94-60201
MARS TRANSFER VEHICLE USING REGOLITH AS PROPELLANT
BRIAN FILLOTSON Boeing Defense and Space Group, Huntsville, AL Journal of Spacecraft and Rockets (ISSN 0022-4650) vol. 31, no. 1 January-February 1994 p. 60-66 refs
(BTN-94-EIX94311322895) Copyright

This paper describes a manned Mars mission architecture that uses planetary regolith from the moon and from Deimos as propellant and as radiation shielding. It presents a points design that uses a mass driver as a rocket engine to eject regolith propellant at high speed, a solar array as a power source for the mass driver, and equipment to acquire and transport regolith to the Mars vehicle. A mission for the 2015 Earth-Mars conjunction is analyzed to assess vehicle mass and crew radiation exposure. EI

A94-60203
ESTIMATION OF THE LOW-EARTH-ORBIT DEBRIS POPULATION AND DISTRIBUTION
KYLE T. ALFRIEND General Research Corp., Vienna, VA and D. LAURIE LEWIS Journal of Spacecraft and Rockets (ISSN 0022-4650) vol. 31, no. 1 January-February 1994 p. 48-53 refs
(BTN-94-EIX94311322893) Copyright

In this paper, an algorithm for estimating the low-Earth-orbit space object population and distribution from measurements taken by a vertical, staring narrow beam radar is developed and validated. The radar measures the altitude, inclination, and radar cross section of each object which passes through the beam. The effects of the assumptions made in developing the algorithm and measurement errors are discussed. An estimate of the operational time of the radar needed to achieve a specified accuracy in the space object population is also developed. EI

N94-33380# Yale Univ., New Haven, CT. School of Medicine.
CELLULAR ANALYSIS OF THE STARTLE REFLEX Annual Report, 1 Sep. 1992 - 31 Aug. 1993
MICHAEL DAVIS 31 Aug. 1993 2 p
(Contract F49620-92-J-0300)
(AD-A278243; AFOSR-94-0224TR) Avail: CASI HC A01/MF A01

In the ASSERT Award we are interested in how dopamine agonists affect baseline startle amplitude as well as the phenomenon of pre-pulse inhibition. To test this, we have been recording the compound action potential generated by an auditory stimulus at the level of the cochlear nucleus in freely moving rats using a bundle of four previously implanted 25 micrometers nichrome wires. Each of the dopamine agonists increased the amplitude of the auditory nerve response (NI component, latency =0.75 msec). This effect is larger following repeated administration of d-amphetamine on each of 7 days, indicating that it shows sensitization. This suggests that dopamine agonists ultimately can alter processes at the very beginning of the auditory system, which we believe may have considerable relevance for dopamine-induced disruption of auditory prepulse inhibition as well as auditory distractibility and even auditory hallucinations in people. DTIC

N94-33499*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
OVERVIEW OF NASA HUMAN RESPONSE TO SONIC BOOM PROGRAM
KEVIN P. SHEPHERD *In its* First Annual High-Speed Research Workshop, Part 3 p 1287-1291 Apr. 1992
Avail: CASI HC A01/MF A06

For some routes the ability to fly at supersonic speeds over land as well as over water would greatly enhance the time benefit to the passenger. It would also increase the productivity and economic viability of the aircraft. There are no reliable guidelines which can be used to determine a sonic boom exposure which would be acceptable for overland supersonic flight. In addition to the peak pressure of the sonic boom, the detailed shape of the signature will also influence the perception, and therefore the community response, to sonic boom exposures. Initially, the program aims to develop the capability to predict human response to individual sonic booms. This will enable a quantitative assessment of the benefit of 'low boom' aircraft configurations and will also serve to guide the design of the aircraft and its operating conditions. This capability will form the foundation of studies to determine the relationship between sonic boom exposure and community response. Only then will it be possible to assess the feasibility of acceptable overland supersonic flight. Author (revised)

N94-33545# Armed Forces Inst. of Pathology, Washington, DC.
EFFECT OF BARBITURATES AND HYPEROXIA ON LIPID PEROXIDATION IN HYPOXIC NEURONS Annual Technical Report, Apr. 1992 - Apr. 1993
WILLIAM J. MEHM 15 Apr. 1993 2 p
(Contract F49620-92-J-0166)
(AD-A278467; AFOSR-94-0220TR) Avail: CASI HC A01/MF A01

This grant was funded for the project 'Effects of Barbiturates and Hyperoxia on Lipid Peroxidation in Hypoxic Neurons' with Chiger, Anderson and Mehm as investigators. The principle investigator departed before any research began. When a new investigator arrived, we found that the proposed model was not appropriate for the research question. We have proposed a change in the research protocol and principle investigator and have requested a not-cost extension. The proposed protocol is 'Oxygen Tension Effects on Wound Healing Molecular Mechanisms' with Kulesh, Anderson and Mehm as investigators. Since that request has not yet been approved, no research has been done. DTIC

N94-33637*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RESPONSE TO GRADED LOWER BODY NEGATIVE PRESSURE (LBNP) AFTER SPACE FLIGHT Abstract Only
S. FORTNEY, J. CHARLES, M. WOOD, and T. DUSSACK *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 495 Jan. 1994
Avail: CASI HC A01/MF A03

The effects of space flight on orthostatic function were studied. LBNP tests (0 to -60 mmHg) were administered to 7 crew members preflight and 2 to 6 hrs after 6 to 9 day shuttle missions. Cardiac stroke volumes were obtained each minute by echo Doppler. Orthostatic responses are given. The data suggest a decline in postflight orthostatic function, as assessed by LBNP, due to reduced cardiac filling despite potentiated heart rate and vasoconstrictor reflex responses in most crew members. Derived from text

N94-33638*# Krug Life Sciences, Inc., San Antonio, TX.
DUAL-CYCLE ERGOMETRY AS AN EXERCISE MODALITY DURING PREBREATHE WITH 100 PERCENT OXYGEN Abstract Only
CRISTINE L. HEAPS, MICHELE D. FISCHER, and JAMES T. WEBB *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 496 Jan. 1994 Prepared in cooperation with Aerospace Medical Research Labs., Brooks AFB, TX
Avail: CASI HC A01/MF A03

In an effort to reduce prebreathe time requirements prior to extravehicular activities and high-altitude flights, a combined arm and leg exercise task proposes to enhance denitrogenation by incorporation of both upper and lower body musculature at a moderately high work intensity during prebreathe with 100% oxygen. Preliminary findings indicated peak oxygen consumption (VO2peak) levels attained on the dual-cycle ergometer do not differ significantly from those levels attained on the treadmill. Eight male subjects were exercised to VO2peak using leg-only cycle ergometry and dual-cycle ergometry on separate days. Preliminary data during dual-cycle ergometry showed arm work equaling 30% of the leg workrate at each stage of the incremental test resulted in arm fatigue in several subjects and a reduced VO2peak compared to dual-cycle ergometry with arm work at 20%. Thus, the 20% workrate was used during the dual-cycle VO2peak trial. On a third experimental day, subjects performed a 10 minute exercise test at a workrate required to elicit 75% of VO2peak for each subject on the dual-cycle ergometer. Blood lactate response to the exercise was monitored as an objective measure of fatigue. Peak VO2 levels attained on the leg-only and the dual-cycle ergometry tasks were not significantly different. Blood lactate levels were significantly elevated following the dual-cycle ergometry at 75% VO2peak. However, lactate levels show the expected rate of decline during recovery and, as demonstrated in the literature, should return to baseline levels within 30 minutes following exercise cessation. Thus, dual-cycle ergometry at 75% VO2peak appears to be a valid exercise for use during prebreathe and should not contribute to fatigue during subsequent EVA's. Author (revised)

N94-33639*# Krug Life Sciences, Inc., San Antonio, TX.

EXERCISE WITH PREBREATHE APPEARS TO INCREASE PROTECTION FROM DECOMPRESSION SICKNESS: PRELIMINARY FINDINGS

JAMES T. WEBB, MICHELE D. FISCHER, CRISTINE L. HEAPS, and ANDREW A. PILMANIS *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 497-500 Jan. 1994 Sponsored in part by Aerospace Medical Research Labs.
(Contract NASA ORDER T-82170; F33615-89-C-0603; F33615-92-C-0018)
Avail: CASI HC A01/MF A03

Extravehicular activity (EVA) from the Space Shuttle involves one hour of prebreath with 100% oxygen, decompression of the entire Shuttle to 10.2 psia for at least 12 hours, and another prebreath for 40 minutes before decompression to the 4.3 psia suit pressure. We are investigating the use of a one-hour prebreathe with 100% oxygen beginning with a ten-minute strenuous exercise period as an alternative for the staged decompression schedule described above. The 10-minute exercise consists of dual-cycle ergometry performed at 75% of the subject's peak oxygen uptake to increase denitrogenation efficiency by increasing ventilation and perfusion. The control exposures were preceded by a one-hour prebreathe with 100% oxygen while resting in a supine position. The twenty-two male subjects were exposed to 4.3 psia for 4 hours while performing light to moderate exercise. Preliminary results from 22 of the planned 26 subjects indicate 76% DCS following supine, resting prebreathe and 38% following prebreathe with exercise. The staged decompression schedule has been shown to result in 23% DCS which is not significantly different from the exercise-enhanced prebreathe results. Prebreathe including exercise appears to be comparable to the protection afforded by the more lengthy staged decompression schedule. Completion of the study later this year will enable planned statistical analysis of the results. Author (revised)

N94-33640*# Army Research Inst. of Environmental Medicine, Natick, MA.

ORTHOSTATIC RESPONSES TO DIETARY SODIUM RESTRICTION DURING HEAT ACCLIMATION

PATRICIA C. SZLYK, INGRID V. SILS, DAVID M. CARETTI, ROBERT J. MOORE, LAWRENCE E. ARMSTRONG, KIM A. TARTARINI, RALPH P. FRANCESCONI, ELDON W. ASKEW, and ROGER W. HUBBARD *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 501-508 Jan. 1994
Avail: CASI HC A02/MF A03

Several studies have shown that individuals consuming low-salt diets and working in the heat have an increased risk or incidence of heat injury, suggestive of inadequate cardiovascular adjustment. Furthermore, others have shown that prolonged work in hot climates can precipitate orthostatic hypotension and syncope. This study was designed to evaluate the effects of moderate-salt (MS) and low-salt (LS) diets on the circulatory responses and incidence of presyncopal symptoms to an orthostatic test (OT) during successive days of heat acclimation (HA). Seventeen unacclimatized male soldiers (mean +/- SE: age 20+/-1 yrs) participated in this two-phase study. The first phase consisted of a seven day dietary stabilization period during which all subjects consumed similar diets of about 4000 kcal/day containing 8g NaCl and lived in a dormitory setting (21 C, 30% RH). The second phase commenced on day eight and consisted of dietary NaCl restriction and 10 days HA (days 8-17). Volunteers were randomly assigned to either the MS diet (n=9) providing 8g NaCl/day or the LS diet (n=8) furnishing just 4g NaCl/day. The acquisition of HA was manifested in both groups by reductions in exercising rectal temperature and heart rate (HR); these characteristics were similar in the MS and LS diets. The OT was performed at 21 C on day seven of the stabilization phase and on days 9, 11, 13, 15, and 17 of the HA phase, before and after 8.5 hr of intermittent treadmill walking in a hot environment. Blood pressure (BP) and HR responses at 1,2, and 4 min and any presyncopal symptoms were recorded after assuming an upright position from recumbency. All subjects completed the OT before and after prolonged exercise in the heat without incidence of either hypotension or presyncopal symptoms irrespective of dietary-salt intake and day of HA. The results indicate that the prolonged work in the heat can be performed without orthostatic hypotension or syncope while consuming 4g NaCl/day with adequate fluid replacement. Furthermore, the circulatory responses to OT showed no improvement with successive days of HA irrespective of dietary-salt intake. Author (revised)

N94-33641*# Naval Air Warfare Center, China Lake, CA.

TELEMEDICINE, VIRTUAL REALITY, AND SURGERY

PERCIVAL D. MCCORMACK and STEVE CHARLES *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 509-521 Jan. 1994
Avail: CASI HC A03/MF A03

Two types of synthetic experience are covered: virtual reality (VR) and surgery, and telemedicine. The topics are presented in viewgraph form and include the following: geometric models; physiological sensors; surgical applications; virtual cadaver; VR surgical simulation; telesurgery; VR Surgical Trainer; abdominal surgery pilot study; advanced abdominal simulator; examples of telemedicine; and telemedicine spacebridge. Derived from text

N94-33643*# Aerospace Medical Research Labs., Brooks AFB, TX.

THE EFFECTIVENESS OF GROUND LEVEL POST-FLIGHT 100 PERCENT OXYGEN BREATHING AS THERAPY FOR PAIN-ONLY ALTITUDE DECOMPRESSION SICKNESS (DCS)

JOHN T. DEMBOSKI and ANDREW A. PILMANIS *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 532-537 Jan. 1994
Avail: CASI HC A02/MF A03

In both the aviation and space environments, decompression sickness (DCS) is an operational limitation. Hyperbaric recompression is the most efficacious treatment for altitude DCS. However, the inherent recompression of descent to ground level while breathing oxygen is in itself therapy for altitude DCS. If pain-only DCS occurs during a hypobaric exposure, and the symptoms resolver during descent, ground level post-flight breathing of 100% O2 for 2 hours

(GLO2) is considered sufficient treatment by USAF Regulation 161-21. The effectiveness of the GLO2 treatment protocol is defined. Derived from text

N94-33644*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
EMERGENCY MEDICAL SERVICES
ROGER BILLICA and MICHAEL CHANDLER *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 538-539 Jan. 1994
Avail: CASI HC A01/MF A03

When NASA was established in 1958, it was known that space flight would require efforts beyond those of NASA to ensure the health and safety of our astronauts. On 10 Aug. 1958, a Secretary of Defense memorandum was signed that assigned the first Department of Defense (DOD) Manager to provide support to NASA for Project Mercury. This established a chain of command through the Joint Chiefs of Staff to the Secretary of Defense. The current charter is dated 19 Mar. 1986 and assigns the DOD Manager responsibilities to the Commander and Chief, US Space Command. The DOD Managers charter has many support areas and among them are recovery of astronauts and medical support. Today these efforts support the Space Shuttle and Space Station Programs. Briefly, the program works with each organization tasking the other through a requirements document. Level of care, communications, and recovery requirements are established; NASA and the DOD provide the capability to meet them. NASA is also responsible for the specialized training and equipment needed to meet these requirements. A Shuttle launch a KSC requires an Emergency Medical Services (EMS) coordinator on console to facilitate communications, ensure proper coverage, and coordinate with area hospitals. A contingent of NASA medical personnel are assembled to provide triage and medical support capabilities. The DOD provides medical evacuation (MEDEVAC) helicopters with surgeons and pararescue specialists (PJ's) or emergency medical technicians (EMT's). Each helicopter is equipped with at least one doctor and one PJ/EMT per astronaut crew member. Transoceanic abort landing (TAL) sites and end of mission (EOM) sites have similar structures, with TAL sites utilizing fixed wingg aircraft for MEDEVAC. The DOD also supports contingency planning for the support and return of crew members from the Space Station Freedom. Much of this support has been directed at the recovery of crew members following the landing of an Assured Crew Return Vehicle. Derived from text

N94-33645*# Army Inst. of Dental Research, Fort Meade, MD.
QUANTITATIVE 3-D IMAGING TOPOGRAMMETRY FOR TELEMEDICINE APPLICATIONS Abstract Only
BRUCE R. ALTSCHULER *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 553 Jan. 1994
Avail: CASI HC A01/MF A03

The technology to reliably transmit high-resolution visual imagery over short to medium distances in real time has led to the serious considerations of the use of telemedicine, telepresence, and telerobotics in the delivery of health care. These concepts may involve, and evolve toward: consultation from remote expert teaching centers; diagnosis; triage; real-time remote advice to the surgeon; and real-time remote surgical instrument manipulation (telerobotics with virtual reality). Further extrapolation leads to teledesign and telereplication of spare surgical parts through quantitative teleimaging of 3-D surfaces tied to CAD/CAM devices and an artificially intelligent archival data base of 'normal' shapes. The ability to generate 'topogrames' or 3-D surface numerical tables of coordinate values capable of creating computer-generated virtual holographic-like displays, machine part replication, and statistical diagnostic shape assessment is critical to the progression of telemedicine. Any virtual reality simulation will remain in 'videogame' realm until realistic dimensional and spatial relational inputs from real measurements in vivo during surgeries are added to an ever-growing statistical data archive. The challenges of managing and interpreting this 3-D data base, which would include radiographic and surface quantitative data, are considerable. As technology drives toward dynamic and continuous 3-D surface measurements, presenting millions of X, Y, Z data points per second of flexing, stretching, moving human organs, the knowledge base and interpretive capabilities of 'brilliant robots' to work as a surgeon's tireless assistants becomes imaginable. The brilliant robot would 'see' what the surgeon sees—and more, for the robot could quantify its 3-D sensing and would 'see' in a wider spectral range than humans, and could zoom its 'eyes' from the macro world to long-distance microscopy. Unerring robot hands could rapidly perform machine-aided suturing with precision micro-sewing machines, splice neural connections with laser welds, micro-bore through constricted vessels, and computer combine ultrasound, microradiography, and 3-D mini-borescopes to quickly assess and trace vascular problems in situ. The spatial relationships between organs, robotic arms, and end-effector diagnostic, manipulative, and surgical instruments would be constantly monitored by the robot 'brain' using inputs from its multiple 3-D quantitative 'eyes' remote sensing, as well as by contact and proximity force measuring devices. Methods to create accurate and quantitative 3-D topograms at continuous video data rates are described. Author (revised)

N94-33647*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
THE PORTABLE DYNAMIC FUNDUS INSTRUMENT: USES IN TELEMEDICINE AND RESEARCH Abstract Only
NORWOOD HUNTER (Krug Life Sciences, Inc., Houston, TX.), MICHAEL CAPUTO (Krug Life Sciences, Inc., Houston, TX.), ROGER BILLICA, GERALD TAYLOR, C. ROBERT GIBSON, F. KEITH MANUEL, THOMAS MADER, and RICHARD MEEHAN *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 555-556 Jan. 1994
Avail: CASI HC A01/MF A03

For years ophthalmic photographs have been used to track the progression of many ocular diseases such as macular degeneration and glaucoma as well as the ocular manifestations of diabetes, hypertension, and hypoxia. In 1987 a project was initiated at the Johnson Space Center (JSC) to develop a means of monitoring retinal vascular caliber and intracranial pressure during space flight. To conduct telemedicine during space flight operations, retinal images would require real-time transmissions from space. Film-based images would not be useful during in-flight operations. Video technology is beneficial in flight because the images may be acquired, recorded, and transmitted to the ground for rapid computer digital image processing and analysis. The computer analysis techniques developed for this project detected vessel caliber changes as small as 3 percent. In the field of telemedicine, the Portable Dynamic Fundus Instrument demonstrates the concept and utility of a small, self-contained video funduscope. It was used to record retinal images during the Gulf War and to transmit retinal images from the Space Shuttle Columbia during STS-50. There are plans to utilize this device to provide a mobile ophthalmic screening service in rural Texas. In the fall of 1993 a medical team in Boulder, Colorado, will transmit real-time images of the retina during remote consultation and diagnosis. The research applications of this device include the capability of operating in remote locations or small, confined test areas. There has been interest shown utilizing retinal imaging during high-G centrifuge tests, high-altitude chamber tests, and aircraft flight tests. A new design plan has been developed to incorporate the video instrumentation into face-mounted goggle. This design would eliminate head restraint devices, thus allowing full maneuverability to the subjects. Further development of software programs will broaden the application of the Portable Dynamic Fundus Instrument in telemedicine and medical research. Author

N94-33651*# Army Research Inst. of Environmental Medicine, Natick, MA. Environmental Physiology and Medical Directorate.
HYDRATION AND BLOOD VOLUME EFFECTS ON HUMAN THERMOREGULATION IN THE HEAT: SPACE APPLICATIONS

MICHAEL N. SAWKA, RICHARD R. GONZALEZ, and KENT B. PANDOLF *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 567-573 Jan. 1994
Avail: CASI HC A02/MF A03

Astronauts exposed to prolonged weightlessness will experience deconditioning, dehydration, and hypovolemia which all adversely affect thermoregulation. These thermoregulatory problems can be minimized by several countermeasures that manipulate body water and vascular volumes. USARIEM scientists have extensively studied dehydration effects and several possible countermeasures including hyperhydration, plasma and erythrocyte volume expansion. This paper reviews USARIEM research into these areas.

Author

N94-33708 Boston Univ., MA.
A SELF-ORGANIZING NEURAL NETWORK ARCHITECTURE FOR AUDITORY AND SPEECH PERCEPTION WITH APPLICATIONS TO ACOUSTIC AND OTHER TEMPORAL PREDICTION PROBLEMS Annual Report, 1 May 1992 - 30 Apr. 1993
STEPHEN GROSSBERG and MICHAEL COHEN Jan. 1994 13 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract F49620-92-J-0225)
(AD-A277526; AFOSR-94-0107TR) Avail: CASI HC A03

This project is developing autonomous neural network models for the real-time perception and production of acoustic and speech signals. A new acoustic filter was developed to show how coarticulated context-sensitive auditory signals can be separated and represented in a more context-independent fashion, thereby easing the recognition problem. Parallel processing streams sensitive to sustained and transient signals are used, as in vision. A model of working memory was developed that automatically compensates for variable acoustic or speech rates. The model shows how invariance of the short term storage of variable-rate acoustic streams can explain data about categorical boundary shifts when the distributions of silent intervals or of vowel durations are altered. New learning and categorization nets were shown to discriminate vowels with comparable accuracy but much higher compression than alternative methods. Models of skilled motor control were developed to clarify how speech and arm movements can be planned and flexibly modified by task requirements. Studies of neural oscillators suggest how rhythmic behaviors relevant to perception and action, notably synchronous oscillations, may be generated and controlled.

DTIC

N94-33779 Wright State Univ., Dayton, OH. Dept. of Psychology.
PATTERN ANALYSIS BASED MODELS OF MASKING BY SPATIALLY SEPARATED SOUND SOURCES Annual Progress Report, 15 May 1992 - 14 May 1993
ROBERT H. GILKEY 15 Jun. 1993 14 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract AF-AFOSR-0289-91) (AD-A277882; AFOSR-94-0137TR)
Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Research is described in three areas: masked detection, sound localization, and neural network models of sound localization. Work on masked detection indicates that substantial reductions in masking of 8 to 18 dB can be realized when the signal is spatially separated from the masker in the free-field. This reduction in masking appears to be mediated by high-frequency information. Headphone-based studies of reproducible noise masking question traditional models of binaural masking, by showing unexpected relations between responses under monaural and binaural conditions. A new response technique was developed to support work on sound localization. Neural network models of sound localization based on binaural stimulus cues can produce responses comparable to those of human observers. Our efforts in laboratory development and in planning the Conference on Binaural and Spatial Hearing are also briefly described.

DTIC

N94-34005# Naval Medical Research and Development Command, Bethesda, MD.
A MODEL FOR PREDICTING CENTRAL NERVOUS SYSTEM TOXICITY FROM HYPERBARIC OXYGEN EXPOSURE IN MAN: EFFECTS OF IMMERSION, EXERCISE, AND OLD AND NEW DATA Technical Report, 1987 - 1994
A. L. HARABIN, S. S. SURVANSHI, and L. D. HOMER Mar. 1994 36 p
(AD-A278348; NMRI-94-0003) Avail: CASI HC A03/MF A01

We analyzed symptoms of central nervous system (CNS) oxygen toxicity from 1726 controlled human hyperbaric O2 exposures at PO2 (Partial pressure of O2) levels ranging from 0.3 to 2.9 atmospheres (atm) using risk models and maximum likelihood analysis, and tested specific hypotheses with likelihood ratios. The data were sorted into dry and immersed, no-exercise, and exercise conditions; new studies were separated from those before 1972. The analysis showed that CNS toxicity, in contrast to pulmonary, increases non-linearly with O2 level (power on O2 greater than 2) and time: the longer an exposure has been, the riskier additional exposure becomes (power on time greater than 1.2). Immersion and exercise each significantly increased the risk of toxicity at any PO2 and time combination. Older studies of immersed, exercised subjects predicted significantly more risk than new studies conducted under comparable conditions and could not be combined for parameter estimation. Reasons for this incompatibility are discussed. Parameters obtained from only the new data predict that current U.S. Navy depth/time limits for O2 diving should keep the incidence of O2 toxicity below 1%, provided recommended purging procedures are followed.

DTIC

N94-34025*# Dartmouth-Hitchcock Medical Center, Lebanon, NH.
SURGERY APPLICATIONS OF VIRTUAL REALITY Abstract Only
JOSEPH ROSEN *In* NASA. Johnson Space Center, The Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 1 p 50 Jan. 1994
Avail: CASI HC A01/MF A04

Virtual reality is a computer-generated technology which allows information to be displayed in a simulated, bus lifelike, environment. In this simulated 'world', users can move and interact as if they were actually a part of that world. This new technology will be useful in many different fields, including the field of surgery. Virtual reality systems can be used to teach surgical anatomy, diagnose surgical problems, plan operations, simulate and perform surgical procedures (telesurgery), and predict the outcomes of surgery. The authors of this paper describe the basic components of a virtual reality surgical system. These components include: the virtual world, the virtual tools, the anatomical model, the software platform, the host computer, the interface, and the head-coupled display. In the chapter they also review the progress towards using virtual reality for surgical training, planning, telesurgery, and predicting outcomes. Finally, the authors present a training system being developed for the practice of new procedures in abdominal surgery.

Author

N94-34111 Oxford Univ. (England). Programming Research Group.
FORMAL DESIGN AND EVALUATION OF A VARIETY OF MEDICAL DIAGNOSTIC PROGRAMS
B. S. TODD and R. STAMPER 1993 145 p
(PB94-149622; PRG-109) Copyright Avail: Issuing Activity (National Technical Information Service (NTIS))

This monograph documents some experiments on computer-aided diagnosis carried out to investigate the effect on diagnostic accuracy of using various statistical and knowledge-based methods to take dependencies between clinical observations into account. The authors present detailed specifications of a variety of statistical and knowledge-based programs within a common formal framework using the Z specification language. They describe how they collected a retrospective database of 1270 cases of abdominal pain of suspected gynecological origin. They used this to evaluate all

methods. The results show that no significant improvement in accuracy can be made by taking interactions into account; independence Bayes is optimal in this application. However, the nearest neighbors method using a new metric appears to be at least as accurate. The authors argue that the nearest neighbors method is more suitable for clinical use than the direct application of independence Bayes because of improved accountability. The computer analysis is encoded and displayed to the user as a small set of actual cases that presented similarly to the new case. The user can retrieve these cases and inspect both their presentations and outcomes if he wishes. The ability to justify and support decisions in this way should be invaluable in safety-critical fields such as medical diagnosis.
NTIS

N94-34602* National Aeronautics and Space Administration, Washington, DC.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 390)
Jul. 1994 53 p
(NASA-SP-7011(390); NAS 1.21:7011(390)) Avail: CASI HC A04

This bibliography lists 102 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System. Subject coverage includes: life sciences (general), aerospace medicine, behavioral sciences, man/system technology and life support, and space biology. Author

N94-34695 Southwest Research Inst., San Antonio, TX.
EVALUATION OF PULSED DOPPLER BUBBLE DETECTION Final Report, 1 Oct. 1988 - 30 Sep. 1989
HEGEON KWUN, W. D. JOLLY, and D. G. ALCAZAR Mar. 1994 44 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract DLA900-84-C-0910; MIPR-FQ7624-89-000001; AF PROJ. 7930)
(AD-A277920; AL/CF-TP-1994-0006) Avail: CASI HC A03

The High Altitude Protection Function of the Crew Technology Division has used a portable Doppler array to monitor venous gas emboli in human research subjects exposed to reduced high altitudes. The existing Doppler equipment was limited in that subjects were required to maintain a specific body position to achieve consistent bubble grade analysis, especially during exercise. It was surmised that engineering modifications might resolve the dilemma. The target frequency and sound wave pulses were to be modified to maintain focus on the precordium allowing for continuous tracking of bubble sounds. A prototype, pulsed-wave, Doppler bubble detection instrument with transducers was designed and developed. This system demonstrated greater depth of penetration and the ability to localize the interrogation area; however, altitude simulation tests revealed the prototype to be unsatisfactory due to the high level of noise generated internally by the CW Doppler circuitry. Recommendations were made of redesign, but development was not pursued due to funding limitations. Also Doppler echo imaging was found to provide equal if not better analysis of bubble grades with the addition of visual cues to ensure accurate placement and timely monitoring regardless of physical activity. DTIC

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N94-33595 New York Univ., New York. Dept. of Psychology.
VISUAL MOTION PERCEPTION AND VISUAL INFORMATION PROCESSING Annual Report, 1 Feb. 1992 - 31 Dec. 1993
GEORGE SPERLING 31 Dec. 1993 22 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract AF-AFOSR-0178-91)
(AD-A278530; AFOSR-94-0205TR) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This project concerned the discovery and description of basic mechanisms of human visual motion and texture perception. Motion and texture are critical inputs to visual perception. Basic mechanisms of motion are of particular interest because they are perhaps the primary substrate for perceptual recovery of 3D depth structures and orientation in space. They are critical for detecting new objects and events in the environment, as well as playing an important role in 2D perception. Motion and texture are considered together here because the problem of discriminating velocity in a one-dimensional motion stimulus is formally equivalent to the problem of discriminating orientation in a texture stimulus: the t dimension of the motion stimulus becomes the y dimension of the texture stimulus. DTIC

N94-33622*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AUTOGENIC-FEEDBACK TRAINING IMPROVES PILOT PERFORMANCE DURING EMERGENCY FLYING CONDITIONS
MICHAEL A. KELLAR (Tripler Army Medical Center, Honolulu, HI.), RAYMOND A. FOLEN (Tripler Army Medical Center, Honolulu, HI.), PATRICIA S. COWINGS, WILLIAM B. TOSCANO, and GLEN L. HISERT *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 395-403 Jan. 1994 See also N93-27076
Avail: CASI HC A02/MF A03

Studies have shown that autonomous mode behavior is one cause of aircraft fatalities due to pilot error. In such cases, the pilot is in a high state of psychological and physiological arousal and tends to focus on one problem, while ignoring more critical information. This study examined the effect of training in physiological self-recognition and regulation, as a means of improving crew cockpit performance. Seventeen pilots were assigned to the treatment and control groups matched for accumulated flight hours. The treatment group comprised three pilots of HC-130 Hercules aircraft and four HH-65 Dolphin helicopter pilots; the control group comprised three pilots of HC-130's and six Dolphin helicopter pilots. During an initial flight, physiological data were recorded for each crew member and individual crew performance was rated by an instructor pilot. Eight crewmembers were then taught to regulate their own physiological response levels using Autogenic-Feedback Training (AFT). The remaining subjects received no training. During a second flight, treatment subjects showed significant improvement in performance, while controls did not improve. The results indicate that AFT management of high states of physiological arousal may improve pilot performance during emergency flying conditions.
Derived from text

N94-33623*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
IMPLEMENTING BRIGHT LIGHT TREATMENT FOR MSFC PAYLOAD OPERATIONS SHIFTWORKERS Abstract Only
BENITA C. HAYES, KAREN T. STEWART, and CHARMANE I. EASTMAN *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 404 Jan. 1994
Avail: CASI HC A01/MF A03

Intense light can phase-shift circadian rhythms and improve performance, sleep, and wellbeing during shiftwork simulations, but to date there have been very few attempts to administer light treatment to real shiftworkers. We have developed procedures for implementing light treatment and have conducted controlled trials of light treatment for MSFC Payload Operations staff during the USML-1 mission. We found that treatment had beneficial effects on fatigue, alertness, self-rated job performance, sleep, mood, and work attendance. Although there are portable bright light boxes commercially available, there is no testing protocol and little performance information available. We measure the illuminance of two candidate boxes for use in this study and found that levels were consistently lower than those advertised by manufacturers. A device was developed to enhance the illuminance output of such units. This device increased the illuminance by at least 60 % and provided additional improvements in visual comfort and overall exposure. Both the design of this device and some suggested procedures for evaluating light devices are presented. Author (revised)

N94-33624*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

FLIGHT CONTROLLER ALERTNESS AND PERFORMANCE DURING MOD SHIFTWORK OPERATIONS

SEAN M. KELLY, MARK R. ROSEKIND, DAVID F. DINGES, DONNA L. MILLER, KELLY A. GILLEN, KEVIN B. GREGORY, RONALD D. AGUILAR, and ROY M. SMITH *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 405-416 Jan. 1994 Sponsored in part by Inst. for Experimental Psychiatry Research Foundation

(Contract NCC2-599)

Avail: CASI HC A03/MF A03

Decreased alertness and performance associated with fatigue, sleep loss, and circadian disruption are issues faced by a diverse range of shiftwork operations. During STS operations, MOD personnel provide 24 hr. coverage of critical tasks. A joint JSC and ARC project was undertaken to examine these issues in flight controllers during MOD shiftwork operations. An initial operational test of procedures and measures was conducted during STS-53 in Dec. 1992. The study measures included a background questionnaire, a subjective daily logbook completed on a 24 hr. basis (to report sleep patterns, work periods, etc.), and an 8 minute performance and mood test battery administered at the beginning, middle, and end of each shift period. Seventeen Flight controllers representing the 3 Orbit shifts participated. The initial results clearly support further data collection during other STS missions to document baseline levels of alertness and performance during MOD shiftwork operations. These issues are especially pertinent for the night shift operations and the acute phase advance required for the transition of day shift personnel into the night for shuttle launch. Implementation and evaluation of the countermeasure strategies to maximize alertness and performance is planned. As STS missions extend to further extended duration orbiters, timelines and planning for 24 circadian disruption will remain highly relevant in the MOD environment. Author (revised)

N94-33625*# Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA.

AUTOMATING THE TRAINING DEVELOPMENT PROCESS FOR MISSION FLIGHT OPERATIONS

CAROL J. SCOTT *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 417-425 Jan. 1994

Avail: CASI HC A02/MF A03

Traditional methods of developing training do not effectively support the changing needs of operational users in a multimission environment. The Automated Training Development System (ATDS) provides advantages over conventional methods in quality, quantity, turnaround, database maintenance, and focus on individualized instruction. The Operations System Training Group at the JPL performed a six-month study to assess the potential of ATDS to automate curriculum development and to generate and maintain course materials. To begin the study, the group acquired readily available hardware and participated in a two-week training session to introduce the process. ATDS is a building activity that combines training's traditional information-gathering with a hierarchical method for interleaving the elements. The program can be described fairly simply. A comprehensive list of candidate tasks determines the content of the database; from that database, selected critical tasks dictate which competencies of skill and knowledge to include in course material for the target audience. The training developer adds pertinent planning information about each task to the database, then ATDS generates a tailored set of instructional material, based on the specific set of selection criteria. Course material consistently leads students to a prescribed level of competency. Author (revised)

N94-33652*# Army Research Inst. of Environmental Medicine, Natick, MA. Environmental Physiology and Medicine Directorate.

PREDICTION MODELING OF PHYSIOLOGICAL RESPONSES AND HUMAN PERFORMANCE IN THE HEAT WITH APPLICATION TO SPACE OPERATIONS

KENT B. PANDOLF, LEANDER A. STROSCHEIN, RICHARD R. GONZALEZ, and MICHAEL N. SAWKA *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 574-581 Jan. 1994

Avail: CASI HC A02/MF A03

This institute has developed a comprehensive USARIEM heat strain model for predicting physiological responses and soldier performance in the heat which has been programmed for use by hand-held calculators, personal computers, and incorporated into the development of a heat strain decision aid. This model deals directly with five major inputs: the clothing worn, the physical work intensity, the state of heat acclimation, the ambient environment (air temperature, relative humidity, wind speed, and solar load), and the accepted heat casualty level. In addition to predicting rectal temperature, heart rate, and sweat loss given the above inputs, our model predicts the expected physical work/rest cycle, the maximum safe physical work time, the estimated recovery time from maximal physical work, and the drinking water requirements associated with each of these situations. This model provides heat injury risk management guidance based on thermal strain predictions from the user specified environmental conditions, soldier characteristics, clothing worn, and the physical work intensity. If heat transfer values for space operations' clothing are known, NASA can use this prediction model to help avoid undue heat strain in astronauts during space flight. Author (revised)

N94-33654*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

LA CHALUPA-30: LESSONS LEARNED FROM A 30-DAY SUBSEA MISSION ANALOGUE

STEVE VANDERARK (Krug Life Sciences, Inc., Houston, TX.), JOANNA WOOD (Krug Life Sciences, Inc., Houston, TX.), and ALBERT W. HOLLAND *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 584-595 Jan. 1994

Avail: CASI HC A03/MF A03

The Behavior and Performance Laboratory (BPL) utilizes space mission analogs to study issues such as the psychological health and well-being, team characteristics, and task performance of crew members on long-duration missions. The analog used in this investigation was an underwater habitat named La Chalupa, which was selected for its similar features to a space station environment. The primary objectives of the La Chalupa-30 investigation were to evaluate the efficiency of several methods for collecting data in remote environments and to assess aspects of living and working under isolated and confined conditions. Derived from text

N94-33674# Johns Hopkins Univ., Baltimore, MD. Dept. of Psychology.

STOCHASTIC MODELS OF ATTENTION AND SEARCH Annual Report, 1 Mar. 1993 - 28 Feb. 1994

STEVEN YANTIS 28 Feb. 1994 20 p

(Contract F49620-92-J-0186)

(AD-A278538; AFOSR-94-0247TR) Avail: CASI HC A03/MF A01

Six lines of experimentation have been continued. In the first set of experiments, the PI has tested and rejected a two-process model of visual attention allocation. He has proposed an alternative perceptual sampling model and performed stochastic simulations of the model to show that it can account for certain aspects of human performance in cued visual search tasks. In the second set of experiments, the PI has found evidence that observers perceive occluded objects across time, a finding that complements an analogous ability to perceptually complete partially occluded objects across space. Several lines of experimentation have been carried our using a bistable apparent motion display (the Ternus display) as a tool to explore the assignment of object identity over time. For example, the PI has found evidence that a common mechanism may underlie the perception of bistable apparent motion and the capture of visual attention in certain visual search tasks, and he has discovered that perceptual grouping by proximity can precede the assignment of motion correspondences in bistable apparent motion. In the fifth project, the PI has shown that visual salience is not sufficient to produce attentional capture; a deliberate state of attentional readiness is required to guide attention according to salient stimulus attributes. DTIC

N94-33700 Rutgers - The State Univ., New Brunswick, NJ. Dept. of Psychology.

EYE MOVEMENTS AND VISUAL INFORMATION PROCESSING Annual Report, 30 Sep. 1992 - 29 Sep. 1993

EILEEN KOWLER 29 Sep. 1993 7 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract AF-AFOSR-0342-91)

(AD-A278364; AFOSR-94-0143TR) Avail: CASI HC A02

When we look around a natural environment the eye is directed toward objects we select. We seem to do this task accurately and effortlessly. Yet, even such a simple task presents real problems for the oculomotor system, namely, to select the relevant target from the detailed background so that only information contained in it influences the line of sight and to spatially pool information in the selected target so that the line of sight lands at a single position within the selected target. We have found that the saccadic target is designated by means of selective perceptual attention, which means people cannot prepare to look to one target while accurately perceiving targets elsewhere, and there is a highly-accurate spatial pooling process which can direct the line of sight to precise positions within large targets. The results show that the oculomotor system is capable of extremely rapid and effective scanning. The procedures humans use to accomplish this task may prove useful for the guidance of robotic systems which need to move about in patterned visual environments. DTIC

N94-33737 Symbus Technology, Inc., Waltham, MA.

WORKSHOP ON SELF-DETERMINATION IN DEVELOPING AND EVOLVING SYSTEMS Final Report, 15 Dec. 1993 - 14 Jan. 1994

MICHAEL KUPERSTEIN 18 Feb. 1994 63 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract F49620-94-C-0011)

(AD-A278367; AFOSR-94-0188TR) Avail: CASI HC A04

Self-determined systems are usually studied by researchers with unrelated terminology and few known common principles. This workshop was aimed at bringing together scientists whose research directly confronts the problems of analyzing, explaining, and building self-determined systems. We hoped that sharing their results and interpretations at the meeting would inspire cross pollination of ideas from different viewpoints and lead to a more unified approach and language to understanding self-determination. The workshop format and discussions were aimed at discovering underlying principles while amplifying little known links between scientific fields. The emphasis was on discovering tools and mechanisms that have general application to research problems in biology, neuroscience, psychology, and computer science. Fifteen researchers came together to explore these issues at Harvard University, January 6-9, 1994. Together, they brought their expertise from biology, neuroscience, developmental psychology, and computational modeling. DTIC

N94-33738 New York Univ., New York. Dept. of Psychology.

VISUAL MOTION PERCEPTION AND VISUAL INFORMATION PROCESSING Final Report, 1 Feb. 1991 - 31 Dec. 1993

GEORGE SPERLING 31 Dec. 1993 161 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract AF-AFOSR-0178-91)

(AD-A278370; AFOSR-94-0159TR)

Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This final progress report summarizes the main recent results; full reports of the results are contained in the papers appended herewith. The summary also reviews some results from previous AFOSR grants where these are necessary to provide the background for the current research. Four areas are summarized: basic mechanisms of visual motion and texture perception; lateral interations in texture stimuli; information processing; and visual attention and short-term memory. DTIC

N94-33849 Boston Univ., MA. Center for Adaptive Systems.

THE COGNITIVE, PERCEPTUAL, AND NEURAL BASES OF SKILLED PERFORMANCE Final Report, 15 Mar. 1990 - 14 Mar. 1993

STEPHEN GROSSBERG Feb. 1994 88 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract AF-AFOSR-0175-90)

(AD-A277608; AFOSR-94-0067TR) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This three-year project partially supported three week-long international scientific meetings and courses on neural network research, 4 research books, more than 100 research articles, 68 Boston-area colloquia, 10 completed PhD theses, and the training of more than 20 graduate students. The research spanned a coordinated program of experimental and modeling studies of how the brain autonomously carries out intelligent behaviors in real-time in response to changing environmental contingencies. Neural models of 3-D vision and figure-around separation, motion perception, visual search, speech perception, working memories for storage of temporal sequences, supervised and unsupervised learning of recognition categories and predictions in response to nonstationary data, arm movement control, and quadruped gait transitions were developed. Technology transfers were made to processing of artificial sensor data, automatic target recognition, several industrial applications, and the control of mobile robots. DTIC

N94-33857 Boston Univ., MA.

NEURAL MODELS OF MOTION PERCEPTION Annual Technical Report, 1 Sep. 1992 - 31 Aug. 1993

STEPHEN GROSSBERG and ENNIO MINGOLLA 22 Feb. 1994 11 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(Contract F49620-92-J-0334)

(AD-A278362; AFOSR-94-0142TR) Avail: CASI HC A03

Eight research projects supported by this grant during the reporting period have resulted in three refereed publications, one under review, one book chapter, and three conference papers. Areas of research included design and simulation of neural architectures for: multichannel data fusion; object recognition and image understanding; development and refinement of algorithms for segmentation, boundary completion, and featural filling-in based on BCS/FCS architectures; network design and simulations of an architecture for breaking of unwanted persistence (hysteresis) of visual segmentations; design of a network architecture for explaining human capabilities for efficient detection of targets in clutter; design and execution of human psychophysical experiments for constraining development of the BCS; design and simulation of a network architecture for enhancing featural contrast and boundary localization at line-ends and corners through a novel circuit analog of VI to lateral geniculate nucleus feedback; and relation of hyperacuity and illusory contour data. DTIC

N94-34024*# Houston Univ., TX.

SHARED VIRTUAL ENVIRONMENTS FOR AEROSPACE TRAINING Abstract Only

R. BOWEN LOFTIN and MARK VOSS *In* NASA. Johnson Space Center, The Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 1 p 49 Jan. 1994
Avail: CASI HC A01/MF A04

Virtual environments have the potential to significantly enhance the training of NASA astronauts and ground-based personnel for a variety of activities. A critical requirement is the need to share virtual environments, in real or near real time, between remote sites. It has been hypothesized that the training of international astronaut crews could be done more cheaply and effectively by utilizing such shared virtual environments in the early stages of mission preparation. The Software Technology Branch at NASA's Johnson Space Center has developed the capability for multiple users to simultaneously share the same virtual environment. Each user generates the graphics needed to create the virtual environment. All changes of object position and state are communicated to all users so that each virtual environment maintains its 'currency.' Examples of these shared environments will be discussed and plans for the utilization of the Department of Defense's Distributed Interactive Simulation (DIS) protocols for shared virtual environments will be presented. Finally, the impact of this technology on training and education in general will be explored. Author

N94-34044*# California Univ., Irvine, CA. Department of Information and Computer Science.

FINDING ACCURATE FRONTIERS: A KNOWLEDGE-INTENSIVE APPROACH TO RELATIONAL LEARNING

MICHAEL PAZZANI and CLIFFORD BRUNK *In* NASA. Johnson Space Center, The Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 1 p 187-193 Jan. 1994
Avail: CASI HC A02/MF A04

An approach to analytic learning is described that searches for accurate entailments of a Horn Clause domain theory. A hill-climbing search, guided by an information based evaluation function, is performed by applying a set of operators that derive frontiers from domain theories. The analytic learning system is one component of a multi-strategy relational learning system. We compare the accuracy of concepts learned with this analytic strategy to concepts learned with an analytic strategy that operationalizes the domain theory. Author

N94-34045*# Oregon State Univ., Corvallis. Dept. of Computer Science.

REINFORCEMENT LEARNING IN SCHEDULING

TOM G. DIETTERICH, DOKYEONG OK, WEI ZHANG, and PRASAD TADEPALLI *In* NASA. Johnson Space Center, The Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 1 p 194-199 Jan. 1994
(Contract NAGW-1293)
Avail: CASI HC A02/MF A04

The goal of this research is to apply reinforcement learning methods to real-world problems like scheduling. In this preliminary paper, we show that learning to solve scheduling problems such as the Space Shuttle Payload Processing and the Automatic Guided Vehicle (AGV) scheduling can be usefully studied in the reinforcement learning framework. We discuss some of the special challenges posed by the scheduling domain to these methods and propose some possible solutions we plan to implement. Author

N94-34108 National Defence Research Establishment, Stockholm (Sweden). Huvudavdelning foer Maenskiig Prestation och Funktion.

CRISIS AND DISASTER RESEARCH: A REVIEW [PROGRAMUTREDNING: KRIS- OCH KATASTROFFORSKNING]

A. ENDANDER, G. LARSSON, and C. WALLENIUS Nov. 1993 94 p In SWEDISH
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The study focuses primarily on individual responses of relevance prior to, during, and immediately after a crisis/disaster event requiring societal or community action. The report comprises four sections: In Section 1 the need for a framework for reviewing the area of disaster research is discussed in relation to three basic problem areas. These concern: similarities and differences between different types of disaster events, the relationship between an event and the individual's subjective interpretation of the event, and finally the issue of classifying human reactions as adaptive or nonadaptive in relation to different criteria. Section 2 focuses on description and analysis of individual reactions in disaster situations. The concepts of appraisal and coping are discussed and applied to disaster situations. In Section 3 empirical studies concerning individual reactions are reviewed in relation to different societal or community responses in dealing with crises/disasters. Four main phases are discussed: prevention and general preparedness, warning and preparation for an identified threat, ways of coping in an actual crisis, and finally the recovery phase. Section 4 provides a discussion of empirical knowledge in disaster research in relation to specifically Swedish conditions. NTIS

N94-34210# Federal Aviation Administration, Oklahoma City, OK. Civil Aeromedical Inst.

VALIDITY OF THE AIR TRAFFIC CONTROL SPECIALIST NONRADAR SCREEN AS A PREDICTOR OF PERFORMANCE IN RADAR-BASED AIR TRAFFIC CONTROL TRAINING Final Report

DANA BROACH and CAROL A. MANNING Apr. 1994 13 p
(DOT/FAA/AM-94/9) Avail: CASI HC A03/MF A01

Between January 1986 and March 1992, the Federal Aviation Administration's 42-day Nonradar Screen was used to identify Air Traffic Control Specialist (ATCS) candidates with the highest potential to succeed in the rigorous ATCS field training program. The central question addressed in this study was whether or not the Nonradar Screen was a valid employee selection procedure in view of the prevalence of radar in today's air traffic control system. To answer that question, we investigated the Nonradar Screen's criterion-related validity as a predictor of subsequent performance in radar-based air traffic control training. We hypothesized that the Nonradar Screen would add incremental validity over aptitude test scores in predicting performance in radar-based air traffic control (ATC) training conducted at the FAA Academy 1 to 2 years after entry into the occupation. Student aptitude test scores and Nonradar Screen final composite scores were regressed on final composite scores earned in radar-based ATC training. Results showed that Nonradar Screen composite scores had incremental validity over the written ATCS aptitude test for predicting radar-based training scores in both en route (Delta R(exp 2) = .08, F(2,438) = 36.52, p less than or equal to .001) and terminal (R(exp 2)= 10, F(2,658) = 77.66, p less than or equal to .001) radar training without correcting for range restriction due to explicit selection on the Nonradar Screen final composite score. After corrections for restriction in range, Nonradar Screen scores accounted for an additional 20 percent of variance in en route (Delta R(exp 2) = .20, F = 146.84, p less than or equal to .001) and an additional 16 percent of variance in terminal (R(exp 2) = .16, F = 178.58, p less than or equal to .001) radar training scores. These results indicated that the Nonradar Screen was a valid predictor of performance in radar-based ATC training. Similarities in nonradar and radar procedures and techniques are offered as possible explanations for the finding of criterion-related validity for the ATCS Nonradar Screen. Author

N94-34699# Helsinki Univ. of Technology, Espoo (Finland). Power Systems and Illumination Engineering Lab.

EFFECTS OF LIGHTING AND TASK PARAMETERS ON VISUAL ACUITY AND PERFORMANCE Ph.D. Thesis

LIISA HALONEN 1993 170 p Sponsored in part by Ministry of

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Lighting and task parameters and their effects on visual acuity and visual performance are discussed. The parameters studied are target contrast, target size, and subject's age; adaptation luminance, luminance ratio between the task and its surroundings, and temporal change in luminances are also studied. Experiments were carried out to examine the effects of luminance and light spectrum on visual acuity. Young normally sighted, older, and low vision people participated in the measurements. On the basis of the visual acuity experiments, a three dimensional visual acuity model (VA-HUT) was developed. The model predicts visual acuity as a function of luminance, target contrast and observer age. On the basis of visual acuity experiments visual acuity reserve values were calculated for different text sizes. Luminance measurements were carried out in an office room with and without daylight. When the lighting or task parameters are near the threshold values, a very small increase in the values improves performance. However, when the values are above a certain value there is unlikely to be any significant improvements in visual acuity or visual performance. ESA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N94-33589 Serv-Air, Inc., Lexington, KY.
INTEGRATION OF THE MOLECULAR SIEVE OXYGEN GENERATING SYSTEM (MSOGS) INTO THE UH-60Q MEDEVAC BLACKHAWK Final Report, 24 Aug. 1992 - 30 May 1993
JOHN HIGHT and ORLANDO CORDERO-MONTALVO 11 Mar. 1994 54 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
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(AD-A277668) Avail: CASI HC A04

A Molecular Sieve Oxygen Generated System (MSOGS) was integrated in the UH-60Q Medevac Helicopter as part of the requirements of this program. Support equipment for the system operation was also integrated in this effort. Problems such as intake air flow cooling and moisture build-up were addressed. Functional and performance tests were conducted by personnel from United States Army Aeromedical Research Laboratory. As a result of the integration effort a more simple and efficient method of installing the MSOGS unit and its supporting systems will be developed. Emphasis will be on the servicing of the oxygen lines on the field to make the system user friendly. DTIC

N94-33608*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AN ETHNOGRAPHIC OBJECT-ORIENTED ANALYSIS OF EXPLORER PRESENCE IN A VOLCANIC TERRAIN ENVIRONMENT: CLAIMS AND EVIDENCE
MICHAEL W. MCGREEVY May 1994 57 p
(Contract RTOP 506-59-65)
(NASA-TM-108823; A-94083; NAS 1.15:108823) Avail: CASI HC A04/MF A01

An ethnographic field study was conducted to investigate the nature of presence in field geology, and to develop specifications for domain-based planetary exploration systems utilizing virtual presence. Two planetary geologists were accompanied on a multi-day geologic field trip that they had arranged for their own scientific purposes, which centered on an investigation of the extraordinary xenolith/nodule deposits in the Kaupulehu lava flow of Hualalai Volcano, on the island of Hawaii. The geologists were observed during the course of their field investigations and interviewed regarding their activities and ideas. Analysis of the interview resulted in the identification of key domain entities and their attributes, relations among the entities, and explorer interactions with the environment. The results support and extend the author's previously reported continuity theory of presence, indicating that presence in field geology is characterized by persistent engagement with objects associated by metonymic relations. The results also provide design specifications for virtual planetary exploration systems, including an integrating structure for disparate data integration. Finally, the results suggest that unobtrusive participant observation coupled with field interviews is an effective research methodology for engineering ethnography. Author

N94-33613*# Brookhaven National Lab., Upton, NY. Human Factors and Performance Analysis Group.
HFE SAFETY REVIEWS OF ADVANCED NUCLEAR POWER PLANT CONTROL ROOMS
JOHN OHARA *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 329-336 Jan. 1994 Sponsored by Nuclear Regulatory Commission
Avail: CASI HC A02/MF A03

Advanced control rooms (ACR's) will utilize human-system interface (HSI) technologies that may have significant implications for plant safety in that they will affect the operator's overall role and means of interacting with the system. The Nuclear Regulatory Commission (NRC) reviews the human factors engineering (HFE) aspects of HSI's to ensure that they are designed to good HFE principles and support performance and reliability in order to protect public health and safety. However, the only available NRC guidance was developed more than ten years ago, and does not adequately address the human performance issues and technology changes associated with ACR's. Accordingly, a new approach to ACR safety reviews was developed based upon the concept of 'convergent validity'. This approach to ACR safety reviews is described. Author (revised)

N94-33619*# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Engineering Div.
FUSION INTERFACES FOR TACTICAL ENVIRONMENTS: AN APPLICATION OF VIRTUAL REALITY TECHNOLOGY
MICHAEL W. HAAS *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 378-387 Jan. 1994
Avail: CASI HC A02/MF A03

The term Fusion Interface is defined as a class of interface which integrally incorporates both virtual and nonvirtual concepts and devices across the visual, auditory, and haptic sensory modalities. A fusion interface is a multisensory virtually-augmented synthetic environment. A new facility has been developed within the Human Engineering Division of the Armstrong Laboratory dedicated to exploratory development of fusion interface concepts. This new facility, the Fusion Interfaces for Tactical Environments (FITE) Facility is a specialized flight simulator enabling efficient concept development through rapid prototyping and direct experience of new fusion concepts. The FITE Facility also supports evaluation of fusion concepts by operation fighter pilots in an air combat environment. The facility is utilized by a multidisciplinary design team composed of human factors engineers, electronics engineers, computer scientists, experimental psychologists, and oeprational pilots. The FITE computational architecture is composed of twenty-five 80486-based microcomputers operating in real-time. The microcomputers generate out-the-window visuals, in-cockpit and head-mounted visuals, localized auditory presentations, haptic displays on the stick and rudder pedals, as well as executing weapons models, aerodynamic models, and threat models. Author (revised)

N94-33620*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

VIRTUAL REALITY AS A HUMAN FACTORS DESIGN ANALYSIS TOOL: MACRO-ERGONOMIC APPLICATION VALIDATION AND ASSESSMENT OF THE SPACE STATION FREEDOM PAYLOAD CONTROL AREA Abstract Only

JOSEPH P. HALE *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 388 Jan. 1994
Avail: CASI HC A01/MF A03

A virtual reality (VR) Applications Program has been under development at MSFC since 1989. Its objectives are to develop, assess, validate, and utilize VR in hardware development, operations development and support, missions operations training, and science training. A variety of activities are under way within many of these areas. One ongoing macro-ergonomic application of VR relates to the design of the Space Station Freedom Payload Control Area (PCA), the control room from which onboard payload operations are managed. Several preliminary conceptual PCA layouts have been developed and modeled in VR. Various managers and potential end users have virtually 'entered' these rooms and provided valuable feedback. Before VR can be used with confidence in a particular application, it must be validated, or calibrated, for that class of applications. Two associated validation studies for macro-ergonomic applications are under way to help characterize possible distortions of filtering of relevant perceptions in a virtual world. In both studies, existing control rooms and their 'virtual counterparts will be empirically compared using distance and heading estimations to objects and subjective assessments. Approaches and findings of the PCA activities and details of the studies are presented. Author (revised)

N94-33621*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

A RAPID ALGORITHM FOR REALISTIC HUMAN REACHING AND ITS USE IN A VIRTUAL REALITY SYSTEM

ANN ALDRIDGE (Lockheed Engineering and Sciences Co., Houston, TX.), ABHILASH PANDYA (Lockheed Engineering and Sciences Co., Houston, TX.), MICHAEL GOLDSBY (Lockheed Engineering and Sciences Co., Houston, TX.), and JAMES MAIDA *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 389-394 Jan. 1994
Avail: CASI HC A02/MF A03

The Graphics Analysis Facility (GRAF) at JSC has developed a rapid algorithm for computing realistic human reaching. The algorithm was applied to GRAF's anthropometrically correct human model and used in a 3D computer graphics system and a virtual reality system. The nature of the algorithm and its uses are discussed. Author

N94-33627*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

TASK NETWORK MODELS IN THE PREDICTION OF WORKLOAD IMPOSED BY EXTRAVEHICULAR ACTIVITIES DURING THE HUBBLE SPACE TELESCOPE SERVICING MISSION

MANUEL F. DIAZ (Lockheed Engineering and Sciences Co., Houston, TX.), NEAL TAKAMOTO (Air Force Systems Command, Brooks AFB, TX.), and BARBARA WOOLFORD *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 432-436 Jan. 1994
Avail: CASI HC A01/MF A03

In a joint effort with Brooks AFB, Texas, the Flight Crew Support Division at JSC has begun a computer simulation and performance modeling program directed at establishing the predictive validity of software tools for modeling human performance during spaceflight. This paper addresses the utility of task network modeling for predicting the workload that astronauts are likely to encounter in extravehicular activities (EVA) during the Hubble Space Telescope (HST) repair mission. The intent of the study was to determine whether two EVA crewmembers and one intravehicular activity (IVA) crewmember could reasonably be expected to complete HST Wide Field/Planetary Camera (WFPC) replacement in the allotted time. Ultimately, examination of the points during HST servicing that may result in excessive workload will lead to recommendations to the HST Flight Systems and Servicing Project concerning (1) expectation of degraded performance, (2) the need to change task allocation across crewmembers, (3) the need to expand the timeline, and (4) the need to increase the number of EVA's. Author (revised)

N94-33628*# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

A HUMAN FACTORS EVALUATION USING TOOLS FOR AUTOMATED KNOWLEDGE ENGINEERING

MARIE E. GOMES and STEPHANIE LIND *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 437-441 Jan. 1994
Avail: CASI HC A01/MF A03

A human factors evaluation of the MH-53J helicopter cockpit is described. This evaluation was an application and futher development of Tools for Automated Knowledge Engineering (TAKE). TAKE is used to acquire and analyze knowledge from domain experts (aircrew members, system designers, maintenance personnel, human factors engineers, or others). TAKE was successfully utilized for the purpose of recommending improvements for the man-machine interfaces (MMI) in the MH-53J cockpit. Author (revised)

N94-33629*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

AN OVERVIEW OF SPACE SHUTTLE ANTHROPOMETRY AND BIOMECHANICS RESEARCH WITH EMPHASIS ON STS/MIR RECUMBENT SEAT SYSTEM DESIGN

GLENN K. KLUTE and LARA E. STOYCOS *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 442-446 Jan. 1994
Avail: CASI HC A01/MF A03

The Anthropometry and Biomechanics Laboratory (ABL) at JSC conducts multi-disciplinary research focusing on maximizing astronaut intravehicular (IVA) and extravehicular (EVA) capabilities to provide the most effective work conditions for manned space flight and exploration missions. Biomechanics involves the measurement and modeling of the strength characteristics of the human body. Current research for the Space Shuttle Program includes the measurement of torque wrench capability during weightlessness, optimization of foot restraint, and hand hold placement, measurements of the strength and dexterity of the pressure gloved hand to improve glove design, quantification of the ability to move and manipulate heavy masses (6672 N or 1500 lb) in weightlessness, and verification of the capability of EVA crewmembers to perform Hubble Space Telescope repair tasks. Anthropometry is the measurement and modeling of the dimensions of the human body. Current research for the Space Shuttle Program includes the measurement of 14 anthropometric parameters of every astronaut candidate, identification of EVA finger entrapment hazards by measuring the dimensions of the gloved hand, definition of flight deck reach envelopes during launch and landing accelerations, and measurement of anthropometric design parameters for the recumbent seat system required for the Shuttle/Mir mission (STS-71, Spacelab M) scheduled for Jun. 1995. Author (revised)

N94-33630*# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Engineering Div.

ANTHROPOMETRIC ACCOMMODATION IN USAF COCKPITS

GREGORY F. ZEHNER *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 447-459 Jan. 1994
Avail: CASI HC A03/MF A03

Over the past three years, a new set of methodologies has been developed to specify and evaluate anthropometric accommodation in USAF crewstation designs. These techniques are used to improve the ability of the pilot to reach controls, to safely escape the aircraft, to achieve adequate mobility and comfort, and to assure full access to the visual field both inside and outside the aircraft. This paper summarized commonly encountered aircraft accommodation problems, explains the failure of the traditional 'percentile man' design concept to resolve these difficulties, and suggests an alternative approach for improving cockpit design to better accommodate today's more heterogeneous flying population. Author (revised)

N94-33634*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

A COMPARISON OF PAPER AND COMPUTER PROCEDURES IN A SHUTTLE FLIGHT ENVIRONMENT

MICHAEL ONEAL (Lockheed Engineering and Sciences Co., Houston, TX.), KRITINA HOLDEN (Lockheed Engineering and Sciences Co., Houston, TX.), STEVE WOLF (Lockheed Engineering and Sciences Co., Houston, TX.), and FRANCES MOUNT *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 483-491 Jan. 1994
Avail: CASI HC A02/MF A03

The Electronic Procedures Experiment (EPROC) was flown as part of the Human Factors Assessment (HFA) experiment aboard the SpaceHab-1/STS-57 mission. EPROC is concerned with future, longer-duration missions which will increasingly rely on electronic procedures since they are more easily launched, updated in-flight, and offer automatic or on-request capabilities not available with paper. A computer-based task simulating a Space Station Propulsion System task was completed by one crewmember. The crewmember performed the task once using paper and once using computer procedures. A soldering and desoldering task was performed by another crewmember. Soldering was completed with paper procedures and desoldering was completed using computer procedures. Objective data was collected during each task session from the computer programs, videotapes, and crew notations in the paper and computer procedures. After each task session, subjective data was collected through the use of a computer-based questionnaire program. Resultant recommendations will be made available to future designers of electronic procedures systems for manned-space missions and other related uses. Author (revised)

N94-33635*# Aerospace Medical Research Labs., Brooks AFB, TX.

GRAVITY, THE THIRD DIMENSION OF LIFE SUPPORT IN SPACE Abstract Only

RUSSELL R. BURTON *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 493 Jan. 1994
Avail: CASI HC A01/MF A03

The ascent of the human into high altitudes required a 2-D life support system that supplied: oxygen, and heat. At lower altitudes, increased oxygen concentration in the inhaled gases was useful, but at higher altitudes for longer durations, this 'clever' life support approach was no longer adequate—physiologic requirements had to provide a natural pressure-based environment. In space, the life support system requires a third dimension, gravity. Although substituting for gravity has been successful on a limited number of physiologic functions for short-duration stays in space, long durations will require the effects of the real thing for critical physiologic functions. It has been known for over a hundred years that the forces of acceleration (G) and gravity are equivalent. Therefore, gravitational stimulation in space can be achieved with centrifugation. However, for this stimulation to be effective, the dosage of G required to maintain normal physiologic function must be determined. An approximation of this dosage of G for the human can be determined with 3-day bed-rest studies including periodic centrifuge exposure. Recent research on this topic is reviewed. Author (revised)

N94-33636*# Naval Air Warfare Center, Warminster, PA.

THE US NAVY/CANADIAN DCIEM RESEARCH INITIATIVE ON PRESSURE BREATHING PHYSIOLOGY Abstract Only

PHILLIP E. WHITLEY *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 494 Jan. 1994
Avail: CASI HC A01/MF A03

Development of improved positive pressure breathing garments for altitude and acceleration protection has occurred without collection of sufficient physiological data to understand the mechanisms of the improvement. Furthermore, modeling of the predicted response of future enhanced garments is greatly hampered by this lack of information. A joint, international effort is under way between Canada's Defense and Civil Institute for Environmental Medicine (DCIEM) and the US Navy's Naval Air Warfare Center Aircraft Division, Warminster (NAWCACDIVWAR). Using a Canadian subject pool, experiments at both the DCIEM altitude facility and the NAWCADIVWAR Dynamic Flight Simulator have been conducted to determine the cardiovascular and respiratory consequences of high levels of positive pressure breathing for altitude and positive pressure breathing for acceleration protection. Various improved pressure breathing garments were used to collect comparative physiological and performance data. New pressure breathing level and durahon capabilities have been encountered. Further studies will address further improvements in pressure suit design and correlation of altitude and acceleration data. Author (revised)

N94-33642*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

TOTAL HYDROCARBON ANALYSIS BY ION MOBILITY SPECTROMETRY

JOHN H. CROSS (Krug Life Sciences, Inc., Houston, TX.), THOMAS F. LIMERO (Krug Life Sciences, Inc., Houston, TX.), and JOHN T. JAMES *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 522-531 Jan. 1994
Avail: CASI HC A02/MF A03

Astronauts must be alerted quickly to chemical leaks that compromise their health and the success of their missions. An ideal leak detector would be equally sensitive to all compounds that might constitute a hazard and insensitive to nontoxic compounds. No ideal sensor exists; thus, selection of a methodology is a series of compromises. The commonly used methods are either insensitive at the low exposure levels set by OSHA, NASA, and other organizations or are selectively insensitive to important classes of chemicals such as Freons. After extensive study and experience, the Toxicology Group at JSC has selected ion mobility spectrometry (IMS) for development into a broad range, sensitive detector. In addition to the sensing method, signal processing is important leak detection because a background signal can be expected at all times. The leak-detecting instrument must be programmed to discriminate between authentic leaks and background fluctuations caused by routine operations. The results of an evaluation of the prototype THA is presented in terms related to spacecraft operations. The evaluation included determination of instrumental parameters such as stability and response times. We also included responses to some common components of spacecraft atmospheres in pure form and in binary and ternary mixtures. The output of the four algorithms to the mixtures was found to be noticeably different. These responses are compared on the basis of their utility for signaling a chemical leak. As a means of evaluating its resistance to a falsely positive response, the THA was challenged with carbon dioxide and methane, compounds whose concentrations normally increase in spacecraft air during human habitation. The instrument showed virtually no response to these interferences. Although the prototype THA is designed for space flight, this detector is expected to be useful for field screening at chemical waste dumps and other environmentally sensitive locations. Author (revised)

N94-33649*# Aerospace Medical Research Labs., Brooks AFB, TX.

PERSONAL COOLING SYSTEMS: POSSIBILITIES AND LIMITATIONS Abstract Only

SARAH A. NUNNELEY *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research

(SOAR 1993), Volume 2 p 559 Jan. 1994
Avail: CASI HC A01/MF A03

Personal thermal control by means of gas- or liquid-conditioned garments was developed during the 1960s and has been applied in a variety of aerospace and industrial settings. Both USAF fighter pilots and astronauts are required to wear heavy protective clothing which insulates them from the environment and thus creates stress through storage of metabolic heat. The problem is particularly severe in astronauts who perform heavy physical work during extra-vehicular activity (EVA); without artificial cooling they could reach incapacitating hyperthermia in a matter of minutes. This paper reviews the factors which influence the design of personal cooling systems. An important early step is determination of acceptable heat stress level, taking into account possible interactions of heat stress with other physiological problems such as motion sickness, diminished plasma volume, decompression sickness and acceleration tolerance. Other factors which require consideration include the work schedule, the area to be covered by the cooling garment, and the practicalities of a fixed or body-mounted heat sink and its power source. Nearly every imaginable heat sink has been proposed or tried over the past 30 years, including direct gas systems, phase-change systems with open or closed loops and thermoelectric heat sinks. The latter are now the system of choice for aircraft. Author

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MODELING HEAT EXCHANGE CHARACTERISTICS OF LONG TERM SPACE OPERATIONS: ROLE OF SKIN WETTEDNESS AND EXERCISE

RICHARD R. GONZALEZ *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 560-566 Jan. 1994
Avail: CASI HC A02/MF A03

The problems of heat exchange during rest and exercise during long term space operations are covered in this report. Particular attention is given to the modeling and description of the consequences of requirement to exercise in a zero-g atmosphere during Space Shuttle flights, especially long term ones. In space environments, there exists no free convection therefore only forced convection occurring by movement, such as pedalling on a cycle ergometer, augments required heat dissipation necessary to regulate body temperature. The requirement to exercise at discrete periods of the day is good practice in order to resist the deleterious consequences of zero-gravity problems and improve distribution of body fluids. However, during exercise (ca. 180 to 250W), in zero-g environments, the mass of eccrine sweating rests as sheets on the skin surface and the sweat cannot evaporate readily. The use of exercise suits with fabrics that have hydrophobic or outwicking properties somewhat distributes the mass of sweat to a larger surface from which to evaporate. However, with no free convection, increased skin wettedness throughout the body surface induces increasing thermal discomfort, particularly during continuous exercise. This report presents several alternatives to aid in this problem: use of intermittent exercise, methods to quantify local skin wettedness, and introduction of a new effective temperature that integrates thermal stress and heat exchange avenues in a zero-g atmosphere. Author

N94-33653*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

EVALUATION OF A LIQUID COOLING GARMENT AS A COMPONENT OF THE LAUNCH AND ENTRY SUIT (LES) Abstract Only

J. WALIGORA, J. CHARLES, I. FRITSCH, S. FORTNEY, S. SICONOLFI, L. PEPPER, L. BAGIAN, and V. KUMAR *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 583 Jan. 1994
Avail: CASI HC A01/MF A03

The LES is a partial pressure suit and a component of the shuttle life support system used during launch and reentry. The LES relies on gas ventilation with cabin air to provide cooling. There are conditions during nominal launch and reentry, landing, and post-landing phases when cabin temperature is elevated. Under these conditions, gas cooling may result in some discomfort and some decrement in orthostatic tolerance. There are emergency conditions involving loss of cabin ECS capability that would challenge crew thermal tolerance. The results of a series of tests are presented. These tests were conducted to assess the effectiveness of a liquid cooled garment in alleviating thermal discomfort, orthostatic intolerance, and thermal intolerance during simulated mission phases. Author

N94-33655*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

COMPARATIVE PERFORMANCE OF A MODIFIED SPACE SHUTTLE REENTRY ANTI-G SUIT (REAGS) WITH AND WITHOUT PRESSURE SOCKS Abstract Only

R. W. KRUTZ, JR. (Krug Life Sciences, Inc., Houston, TX.), G. L. RIPLEY (Krug Life Sciences, Inc., Houston, TX.), J. A. MARSHALL (Aerospace Medical Research Labs., Brooks AFB, TX.), and C. F. SAWIN *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 596 Jan. 1994
Avail: CASI HC A01/MF A03

In a prior study, the Armstrong Laboratory (AL) demonstrated that +G(sub z) protection during simulated shuttle reentry could be improved with an extended coverage anti-G suit with pressure socks but no abdominal bladder (REAGS). In a subsequent study conducted at the NASA Johnson Space Center it was shown that REAGS had a down side which included restricted mobility (during simulated shuttle egress) and a larger boot size needed for the pressure socks. The present study was conducted using a modified REAGS to increase mobility during egress. The size of the crotch opening was increased, and the fabric covering the buttocks was replaced with more elastic material. Six healthy male members of the AL centrifuge panel served as subjects for the study. As in the earlier study, subjects received 20 to 35 mg of IV Lasix approximately 6 hours before being exposed to a simulated space shuttle reentry +G(sub z) profile on the AL centrifuge, which induced a mean weight loss of 2.8 percent, range 2.1 percent to 3.7 percent. The REAGS was inflated to 1.0 psig 10 minutes prior to G onset. The G-profile was identical to that used in the previous REAGS study. Physiologic parameters monitored were also the same, i.e., eye-level systolic blood pressure (ELBP) using the Finapres digital cuff technique and heart rate and rhythm. Subjective comments were obtained from questionnaires administered after the increased G exposure. Systolic ELBP was maintained at 60 mm Hg or above by pressurizing the anti-G suit in 0.5 psig increments up to a maximum pressure of 2.5 psig. There were no significant differences in mean G-suit pressure required to maintain systolic ELBP at 60 mm Hg or above between the REAGS worn with and without pressure socks. Maximum mean G-levels achieved during the GOR were also the same under both experimental conditions, i.e., 4.7 G with socks and 4.6 G without socks. These G-levels were essentially the same as recorded earlier with the unmodified REAGS. There were no significant differences in comfort rating during the G exposure assigned by subjects when they wore the modified REAGS with or without the pressure socks. Author (revised)

N94-33656*# Aerospace Medical Research Labs., Brooks AFB, TX.

CURRENT AND FUTURE ISSUES IN USAF FULL PRESSURE SUIT RESEARCH AND DEVELOPMENT Abstract Only

TERRELL E. SCOGGINS *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 597 Jan. 1994
Avail: CASI HC A01/MF A03

Although the full pressure suits currently in the USAF operational inventory provide acceptable performance and crew protection for these missions, there is considerable room for improvement, especially in the areas of comfort, mobility, glove and helmet performance, and maintenance/supportability. As future aircraft push the envelope towards operations at higher and higher altitudes and transatmospheric flight, advances in full pressure suit technology will be needed. Also, enhanced pressure suit technology will be required to meet NASA's need for protection during future EVA operations for both on-orbit and planetary surface missions. This presentation will review the results of efforts at the Armstrong Laboratory to develop and demonstrate advanced full pressure suit technology for use in future high-altitude reconnaissance aircraft and transatmospheric vehicle operations. For those readers who may not be familiar with this area of life support equipment, a brief review of the important physiological and operational requirements for full pressure suits used in these applications will be addressed first, followed by a summary of the current state-of-the-art in USAF pressure suit technology. Ongoing and recently completed work on enhanced mobility pressure suit joints and improved pressure suit gloves will then be reviewed. The presentation will conclude with discussion of the technical challenges for successful development of an advanced full pressure suit for aerospace operations in the 21st century. Author (revised)

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ADVANCED INTEGRATED LIFE SUPPORT SYSTEM UPDATE Abstract Only

PHILLIP E. WHITLEY *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 598 Jan. 1994

Avail: CASI HC A01/MF A03

The Advanced Integrated Life Support System Program (AILSS) is an advanced development effort to integrate the life support and protection requirements using the U.S. Navy's fighter/attack mission as a starting point. The goal of AILSS is to optimally mate protection from altitude, acceleration, chemical/biological agent, thermal environment (hot, cold, and cold water immersion) stress as well as mission enhancement through improved restraint, night vision, and head-mounted reticules and displays to ensure mission capability. The primary emphasis to date has been to establish garment design requirements and tradeoffs for protection. Here the garment and the human interface are treated as a system. Twelve state-off-the-art concepts from government and industry were evaluated for design versus performance. On the basis of a combination of centrifuge, thermal manikin data, thermal modeling, and mobility studies, some key design parameters have been determined. Future efforts will concentrate on the integration of protection through garment design and the use of a single layer, multiple function concept to streamline the garment system. Author

N94-33659*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

CHARACTERIZATION OF SPACECRAFT HUMIDITY CONDENSATE Abstract Only

SUSAN MUCKLE (Krug Life Sciences, Inc., Houston, TX.), JOHN R. SCHULTZ (Krug Life Sciences, Inc., Houston, TX.), and RICHARD L. SAUER *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 600 Jan. 1994

Avail: CASI HC A01/MF A03

When construction of Space Station Freedom reaches the Permanent Manned Capability (PMC) stage, the Water Recovery and Management Subsystem will be fully operational such that (distilled) urine, spent hygiene water, and humidity condensate will be reclaimed to provide water of potable quality. The reclamation technologies currently baselined to process these waste waters include adsorption, ion exchange, catalytic oxidation, and disinfection. To ensure that the baseline technologies will be able to effectively remove those compounds presenting a health risk to the crew, the National Research Council has recommended that additional information be gathered on specific contaminants in waste waters representative of those to be encountered on the Space Station. With the application of new analytical methods and the analysis of waste water samples more representative of the Space Station environment, advances in the identification of the specific contaminants continue to be made. Efforts by the Water and Food Analytical Laboratory at JSC were successful in enlarging the database of contaminants in humidity condensate. These efforts have not only included the chemical characterization of condensate generated during ground-based studies, but most significantly the characterization of cabin and Spacelab condensate generated during Shuttle missions. The analytical results presented in this paper will be used to show how the composition of condensate varies amongst enclosed environments and thus the importance of collecting condensate from an environment close to that of the proposed Space Station. Although advances were made in the characterization of space condensate, complete characterization, particularly of the organics, requires further development of analytical methods. Author (revised)

N94-33660*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

COMPUTATION OF IODINE SPECIES CONCENTRATIONS IN WATER Abstract Only

JOHN R. SCHULTZ (Krug Life Sciences, Inc., Houston, TX.), PAUL D. MUDGETT (Krug Life Sciences, Inc., Houston, TX.), DAVID T. FLANAGAN (Krug Life Sciences, Inc., Houston, TX.), and RICHARD L. SAUER *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 601 Jan. 1994

Avail: CASI HC A01/MF A03

During an evaluation of the use of iodine as a water disinfectant and the development of methods for measuring various iodine species in water onboard Space Freedom, it became necessary to compute the concentration of the various species based on equilibrium principles alone. Of particular concern was the case when various amounts of iodine, iodide, strong acid, and strong base are added to water. Such solutions can be used to evaluate the performance of various monitoring methods being considered. The authors of this paper present an overview of aqueous iodine chemistry, a set of nonlinear equations which can be used to model the above case, and a computer program for solving this system of equations using the Newton-Raphson method. The program was validated by comparing results over a range of concentrations and pH values with those previously presented by Gottardi for a given pH. Use of this program indicated that there are multiple roots to many cases and selecting an appropriate initial guess is important. Comparison of program results with laboratory results for the case when only iodine is added to water indicates the program gives high pH values for the iodine concentrations normally used for water disinfection. Extending the model to include the effects of iodate formation results in the computer pH values being closer to those observed, but the model with iodate does not agree well for the case in which base is added in addition to iodine to raise the pH. Potential explanations include failure to obtain equilibrium conditions in the lab, inaccuracies in published values for the equilibrium constants, and inadequate model of iodine chemistry and/or the lack of adequate analytical methods for measuring the various iodine species in water. Author (revised)

N94-33661*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

A VOLATILE ORGANIC ANALYZER FOR SPACE STATION: DESCRIPTION AND EVALUATION OF A GAS CHROMATOGRAPHY/ ION MOBILITY Abstract Only

THOMAS F. LIMERO (Krug Life Sciences, Inc., Houston, TX.) and JOHN T. JAMES *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 602 Jan. 1994

Avail: CASI HC A01/MF A03

A Volatile Organic Analyzer (VOA) is being developed as an essential component of the Space Station's Environmental Health System (EHS) air quality monitoring strategy to provide warning to the crew and ground personnel if volatile organic compounds exceed established exposure limits. The short duration of most

Shuttle flights and the relative simplicity of the contaminant removal mechanism have lessened the concern about crew exposure to air contaminants on the Shuttle. However, the longer missions associated with the Space Station, the complex air revitalization system and the proposed number of experiments have led to a desire for real-time monitoring of the contaminants in the Space Station atmosphere. Achieving the performance requirements established for the VOA within the Space Station resource (e.g., power, weight) allocations led to a novel approach that joined a gas chromatograph (GC) to an ion mobility spectrometer (IMS). The authors of this paper will discuss the rational for selecting the GC/IMS technology as opposed to the more established gas chromatography/mass spectrometry (GC/MS) for the foundation of the VOA. The data presented from preliminary evaluations will demonstrate the versatile capability of the GC/IMS to analyze the major contaminants expected in the Space Station atmosphere. The favorable GC/IMS characteristics illustrated in this paper included excellent sensitivity, dual-mode operation for selective detection, and mobility drift times to distinguish co-eluting GC peaks. Preliminary studies have shown that the GC/IMS technology can meet surpass the performance requirements of the Space Station VOA. Author (revised)

N94-33662*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

SAFETY CONCERNS FOR FIRST ENTRY OPERATIONS OF ORBITING SPACECRAFT Abstract Only

STEVEN H. WILSON (Krug Life Sciences, Inc., Houston, TX.), THOMAS F. LIMERO (Krug Life Sciences, Inc., Houston, TX.), and JOHN T. JAMES *In its* Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 603 Jan. 1994
Avail: CASI HC A01/MF A03

The Space Station Freedom crew will face operational problems unique to the spacecraft environment due to the absence of convection currents and the confined atmosphere within the habitable modules. Airborne contaminants from the materials offgassing or contingency incidents like thermodegradation may accumulate until they reach hazardous concentrations. Flow modeling and experiences from previous space flight missions confirm that caution must be exercised during first-entry operations. A review of the first-entry procedures performed during the Skylab Program will be presented to highlight the necessity for carefully planned operations. Many of the environmental conditions that can be expected on the Space Station are analogous to those which exist in confined storage or work spaces in the industrial setting. Experience with closed-loop environmental operations (e.g., atmospheric control of submarines) have also demonstrated that the buildup of trace contaminant gases could result in conditions that lead to mission termination or loss of crew. Consequently, some first-entry issues for the Station can be addressed by comparing them to familiar techniques developed on Earth. The instruments of the Environmental Health System (EHS) will provide the necessary monitoring capability to protect crew health and safety during the planned first-entry procedures of the MTC phase of the SSF Program. The authors of this paper will describe those procedures and will cite an example of the consequences when proper first-entry procedures are not followed. Author (revised)

N94-33663*# McDonnell Aircraft Co., Saint Louis, MO.

UNIQUE METHODS FOR ON-ORBIT STRUCTURAL REPAIR, MAINTENANCE, AND ASSEMBLY

RAY ANDERSON and PHIL FUSON *In* NASA. Johnson Space Center, Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 2 p 605-610 Jan. 1994
Avail: CASI HC A02/MF A03

This paper reviews the MDA independent research and development (IRAD) efforts since 1986 in the development of two distinctly different approaches to on-orbit tube repair: (1) one-piece mechanical tube fittings that are forced, under pressure, onto the tube outer surface to effect the repair; and (2) electron beam weldings as demonstrated with the Paton-developed universal hand tool (UHT) space welding system for the repair of fluid lines and tubular components. Other areas of potential on-orbit repair using the UHT include damage to the flat or curved surfaces of habitation modules and truss assemblies. This paper will also address MDA evaluation of the Paton UHT system for on-orbit coating, cleaning, brazing, and cutting of metals. MDA development of an on-orbit compatible nondestructive evaluation (NDE) system for the inspection of tube welds is an important part of this complete space welding capability and will be discussed in a separate paper. Author

N94-33707 Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

EFFECTS OF HEAT ACCLIMATION ON HEAT-EXERCISE TOLERANCE IN UNTRAINED AND ENDURANCE-TRAINED MEN WEARING NBC PROTECTIVE CLOTHING

YUKITOSHI AOYAGI, TOM M. MCLELLAN, and ROY J. SHEPHARD Aug. 1993 37 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A277522; DCIEM-93-47) Avail: CASI HC A03

Responses were compared between nine untrained (UT) men and six men who had participated in 8 weeks of endurance training (ET). Both groups underwent 6 days of heat acclimation in a climatic chamber that was maintained at 40 +/- 0.5 C and 30 +/- 1% rh. Subjects were tested before and after acclimation wearing either standard military combat clothing or nuclear, biological and/or chemical (NBC) protective clothing. Test sessions involved treadmill walking at 4.8 km/h and 2% grade for a maximum of 120 min. In UT subjects, heat acclimation increased plasma volume (+8 +/- 2%), but VO sub 2max and heat-exercise tolerance time were unchanged. When wearing standard combat clothing, acclimation decreased average values of heart rate, rectal temperature (T sub re), mean skin temperature (T sub sk), thermal discomfort, and metabolic heat production. When wearing NBC protective clothing, the only significant change was in T sub re. Acclimation induced an increase of sweat secretion but no statistically significant increase of sweat evaporation in NBC protective clothing. In ET subjects, acclimation reduced thermal discomfort when wearing standard combat clothing, and T sub re and T sub sk when wearing NBC protective clothing. The results suggest that heat acclimation did little to improve exercise tolerance when wearing NBC protective clothing in hot environments, although it reduced thermoregulatory strain by lowering mean body temperature, irrespective of training status. DTIC

N94-33781 Department of the Navy, Washington, DC.

ADVANCED EYE OR SENSOR PROTECTION AND HIGH SPEED VARIABLE OPTICAL ATTENUATION SYSTEM Patent

WILLIAM B. CUSHMAN, inventor (to Navy) 19 Oct. 1993 5 p Filed 14 Feb. 1992
(AD-D016150; US-PATENT-5,255,117; US-PATENT-APPL-SN-842287; US-PATENT-CLASS-359-234) Avail: US Patent and Trademark Office

In order to protect the eyes or other sensor, from light produced, e.g., by modern laser weapons which have extremely fast onset times and high power per pulse, a protective shutter device is provided which is based on the integrative property of such sensors. The sensor is shielded for a large proportion of the time and only exposed after a light detector associated with the protective device has assured a safe environment. The normal exposure provided is a series of rapid image-views that integrate over time within the sensor. In an eye goggles embodiment, clear vision is maintained and a fast-response variable-density 'sunglass' is perceived by the wearer. Only one eye is exposed and thus at risk at any one time, and that eye only about 10% of the total time. A high-speed mechanical shutter controls the exposure experienced by the sensor. DTIC

N94-33957*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

EVALUATION OF LENS DISTORTION ERRORS USING AN UNDERWATER CAMERA SYSTEM FOR VIDEO-BASED MOTION ANALYSIS

JEFFREY POLINER (Lockheed Engineering and Sciences Co., Houston, TX.), LAUREN FLETCHER, and GLENN K. KLUTE Jul. 1994 19 p
(NASA-TM-104795; S-769; NAS 1.15:104795) Avail: CASI HC A03/MF A01

Video-based motion analysis systems are widely employed to study human movement, using computers to capture, store, process, and analyze video data. This data can be collected in any environment where cameras can be located. One of the NASA facilities where human performance research is conducted is the Weightless Environment Training Facility (WETF), a pool of water which simulates zero-gravity with neutral buoyance. Underwater video collection in the WETF poses some unique problems. This project evaluates the error caused by the lens distortion of the WETF cameras. A grid of points of known dimensions was constructed and videotaped using a video vault underwater system. Recorded images were played back on a VCR and a personal computer grabbed and stored the images on disk. These images were then digitized to give calculated coordinates for the grid points. Errors were calculated as the distance from the known coordinates of the points to the calculated coordinates. It was demonstrated that errors from lens distortion could be as high as 8 percent. By avoiding the outermost regions of a wide-angle lens, the error can be kept smaller.
Author

N94-33973*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

TRACE CONTAMINANT CONTROL SIMULATION COMPUTER PROGRAM, VERSION 8.1

J. L. PERRY May 1994 126 p
(NASA-TM-108457; NAS 1.15:108457) Avail: CASI HC A07/MF A02

The Trace Contaminant Control Simulation computer program is a tool for assessing the performance of various process technologies for removing trace chemical contamination from a spacecraft cabin atmosphere. Included in the simulation are chemical and physical adsorption by activated charcoal, chemical adsorption by lithium hydroxide, absorption by humidity condensate, and low- and high-temperature catalytic oxidation. Means are provided for simulating regenerable as well as nonregenerable systems. The program provides an overall mass balance of chemical contaminants in a spacecraft cabin given specified generation rates. Removal rates are based on device flow rates specified by the user and calculated removal efficiencies based on cabin concentration and removal technology experimental data. Versions 1.0 through 8.0 are documented in NASA TM-108409. TM-108409 also contains a source file listing for version 8.0. Changes to version 8.0 are documented in this technical memorandum and a source file listing for the modified version, version 8.1, is provided. Detailed descriptions for the computer program subprograms are extracted from TM-108409 and modified as necessary to reflect version 8.1. Version 8.1 supersedes version 8.0. Information on a separate user's guide is available from the author.
Author

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EVA-SCRAM OPERATIONS

LEE A. FLANIGAN (Rockwell International Corp., Huntsville, AL.), DAVID TAMIR (Rockwell International Corp., Cocoa Beach, FL.), JACK L. WEEKS (Rockwell International Corp., Huntsville, AL.), SIDNEY R. MCCLURE, and ANDREW G. KIMBROUGH *In* NASA. Johnson Space Center, The Seventh Annual Workshop on Space Operations Applications and Research (SOAR 1993), Volume 1 p 121-129 Jan. 1994
Avail: CASI HC A02/MF A04

This paper wrestles with the on-orbit operational challenges introduced by the proposed Space Construction, Repair, and Maintenance (SCRAM) tool kit for Extra-Vehicular Activity (EVA). SCRAM undertakes a new challenging series of on-orbit tasks in support of the near-term Hubble Space Telescope, Extended Duration Orbiter, Long Duration Orbiter, Space Station Freedom, other orbital platforms, and even the future manned Lunar/Mars missions. These new EVA tasks involve welding, brazing, cutting, coating, heat-treating, and cleaning operations. Anticipated near-term EVA-SCRAM applications include construction of fluid lines and structural members, repair of punctures by orbital debris, refurbishment of surfaces eroded by atomic oxygen, and cleaning of optical, solar panel, and high emissivity radiator surfaces which have been degraded by contaminants. Future EVA-SCRAM applications are also examined, involving mass production tasks automated with robotics and artificial intelligence, for construction of large truss, aerobrake, and reactor shadow shield structures. Realistically achieving EVA-SCRAM is examined by addressing manual, teleoperated, semi-automated, and fully-automated operation modes. The operational challenges posed by EVA-SCRAM tasks are reviewed with respect to capabilities of existing and upcoming EVA systems, such as the Extravehicular Mobility Unit, the Shuttle Remote Manipulating System, the Dexterous End Effector, and the Servicing Aid Tool.
Author

N94-34389# Federal Aviation Administration, Oklahoma City, OK. Civil Aeromedical Inst.

THE EFFECTS OF COLD EXPOSURE ON WET AIRCRAFT PASSENGERS: A REVIEW Final Report

ROBERT P. GARNER, BRUCE C. WILCOX, HARVEY M. ENGLAND, and VAN B. NAKAGAWARA May 1994 12 p
(DOT/FAA/AM-94/10) Avail: CASI HC A03/MF A01

The incorporation of a cabin water spray system (CWSS) aboard commercial passenger aircraft has been suggested as a mechanism of reducing passenger death and injury from the fire and smoke commonly associated with aircraft accidents. A potential health risk associated with a CWSS is the physiological stress that would be imposed upon an individual by being wet from a CWSS in the aircraft cabin and then evacuated into a cold environment. The severity of this type of exposure would be proportional to the degree to which the individual was doused with water and the wind speed and inversely proportionally to the ambient temperature. The physiological responses to partial wetting and subsequent exposure to cold environmental conditions have not been studied. The effects of cold exposure as well as the degree of protection provided to the individual, particularly the cardiorespiratory system, by CWSS would need to be fully investigated to determine if the survival benefits of a CWSS outweigh the potential health risks. Author

N94-34627# Sikorsky Aircraft, Stratford, CT. Crew Station Design.

EXPANDING THE PILOT'S ENVELOPE

BRUCE E. HAMILTON *In* AGARD, Technologies for Highly Manoeuvrable Aircraft 6 p Mar. 1994
Copyright Avail: CASI HC A02/MF A03

Advances in aircraft technology have allowed the construction of fighters which can easily exceed the pilot's capability to react and to sustain G forces. Advances in avionics have allowed these airframes to be fitted with sensors, weapons, and data processors to the point that the workload associated with mission accomplishment sometimes exceeds the pilot's capabilities. Consequently, some aircraft capabilities are rarely used due to lack of familiarity. These developments highlight the fact that the ability of the aircraft to fulfill its mission is dependent upon the pilot's utilizing its capabilities as an integrated weapon system. Pilots, like airframes, have operational envelopes and expanding the pilot's envelope allows fuller exploitation of the airframe's envelope and the avionics capabilities. The nature of the pilot's envelope is presented along with attributes of a pilot interface which support expansion of the pilot's envelope.
Author (revised)

N94-34706*# Sterling Software, Inc., Palo Alto, CA.

MAN-MACHINE INTEGRATION DESIGN AND ANALYSIS SYSTEM (MIDAS) TASK LOADING MODEL (TLM) EXPERIMENTAL AND SOFTWARE DETAILED DESIGN REPORT

LOWELL STAVELAND May 1994 75 p Sponsored in cooperation

with USAATCOM
(Contract NAS2-13210)
(NASA-CR-177640; A-94080; NAS 1.26:177640; USAATCOM-TR-94-A-012) Avail: CASI HC A04/MF A01

This is the experimental and software detailed design report for the prototype task loading model (TLM) developed as part of the man-machine integration design and analysis system (MIDAS), as implemented and tested in phase 6 of the Army-NASA Aircrew/Aircraft Integration (A3I) Program. The A3I program is an exploratory development effort to advance the capabilities and use of computational representations of human performance and behavior in the design, synthesis, and analysis of manned systems. The MIDAS TLM computationally models the demands designs impose on operators to aide engineers in the conceptual design of aircraft crewstations. This report describes TLM and the results of a series of experiments which were run this phase to test its capabilities as a predictive task demand modeling tool. Specifically, it includes discussions of: the inputs and outputs of TLM, the theories underlying it, the results of the test experiments, the use of the TLM as both stand alone tool and part of a complete human operator simulation, and a brief introduction to the TLM software design.

Derived from text

N94-35115* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

PROSTHETIC ELBOW JOINT Patent

BRUCE C. WEDDENDORF, inventor (to NASA) 24 May 1994 9 p Filed 8 Jul. 1992 Supersedes N93-30566 (31 - 11, p 3508)
(NASA-CASE-MFS-28707-1; US-PATENT-5,314,500; US-PATENT-APPL-SN-912953; US-PATENT-CLASS-623-57; US-PATENT-CLASS-623-59; US-PATENT-CLASS-623-60; INT-PATENT-CLASS-A61F-2/66; INT-PATENT-CLASS-A61F-2/54; INT-PATENT-CLASS-A61F-2/58) Avail: US Patent and Trademark Office

An artificial, manually positionable elbow joint for use in an upper extremity, above-elbow, prosthetic is described. The prosthesis provides a locking feature that is easily controlled by the wearer. The instant elbow joint is very strong and durable enough to withstand the repeated heavy loadings encountered by a wearer who works in an industrial, construction, farming, or similar environment. The elbow joint of the present invention comprises a turntable, a frame, a forearm, and a locking assembly. The frame generally includes a housing for the locking assembly and two protruding ears. The forearm includes an elongated beam having a cup-shaped cylindrical member at one end and a locking wheel having a plurality of holes along a circular arc on its other end with a central bore for pivotal attachment to the protruding ears of the frame. The locking assembly includes a collar having a central opening with a plurality of internal grooves, a plurality of internal cam members each having a chamfered surface at one end and a V-shaped slot at its other end; an elongated locking pin having a crown wheel with cam surfaces and locking lugs secured thereto; two coiled compression springs; and a flexible filament attached to one end of the elongated locking pin and extending from the locking assembly for extending and retracting the locking pin into the holes in the locking wheel to permit selective adjustment of the forearm relative to the frame. In use, the turntable is affixed to the upper arm part of the prosthetic in the conventional manner, and the cup-shaped cylindrical member on one end of the forearm is affixed to the forearm piece of the prosthetic in the conventional manner. The elbow joint is easily adjusted and locked between maximum flex and extended positions.

Official Gazette of the U.S. Patent and Trademark Office

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

N94-34951*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

US EXPERIMENT FLOWN ON THE SOVIET BIOSATELLITE COSMOS 1667 Final Report

JOHN W. HINES, ed. and MICHAEL G. SKIDMORE, ed. May 1994 133 p
(Contract RTOP 199-70-12)
(NASA-TM-108803; A-94032; NAS 1.15:108803) Avail: CASI HC A07/MF A02

Two male young-adult rhesus monkeys were flown on the Soviet Biosatellite Cosmos 1667 for seven days from July 10-17, 1985. Both animals were instrumented to record neurophysiological parameters. One animal, Gordyy, was additionally instrumented to record cardiovascular changes. Space capsule and environmental parameters were very similar to those of previous missions. On Cosmos 1514, which flew for five days in 1983, one animal was fitted with a left carotid artery cuff to measure blood pressure and flow velocity. An additional feature of Cosmos 1667 was a postflight control study using the flight animal. Intermittent postural tilt tests were also conducted before and after spaceflight and synchronous control studies, to simulate the fluid shifts associated with spaceflight. The experiment results support the conclusion derived from Cosmos 1514 that significant cardiovascular changes occur with spaceflight. The changes most clearly seen were rapid initial decreases in heart rate and further decreases with continued exposure to microgravity. The triggering mechanism appeared to be a headward shift in blood and tissue fluid volume which, in turn, triggered adaptive cardiovascular changes. Adaptive changes took place rapidly and began to stabilize after the first two days of flight. However, these changes did not plateau in the animal by the last day of the mission.

Author

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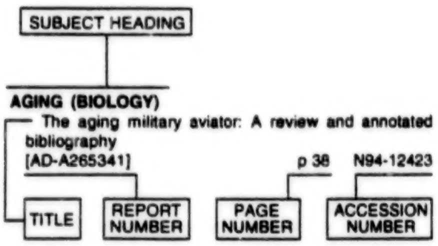
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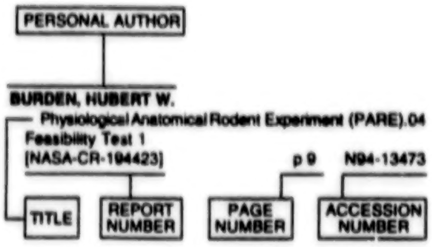

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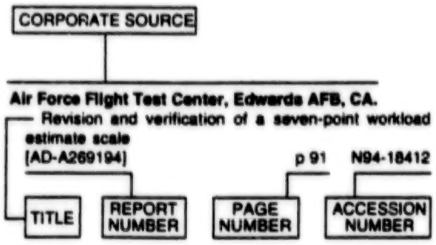
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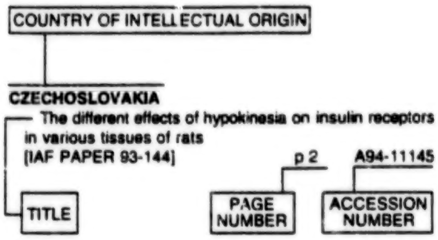
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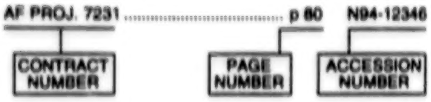

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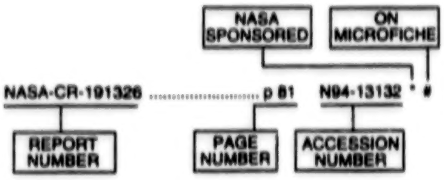

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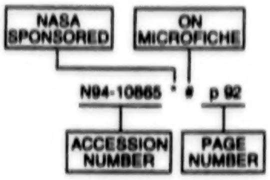

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